AGRICULTURAL ENGINEERING

SEPTEMBER • 1956

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•

Substitution of Term "Product Preparation" for "Product Processing" Favored

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Recent Developments in Agricultural Chains Influenced by Industry Demands

•

Instrument Developed to Record Heart Rate During Work for Energy Studies

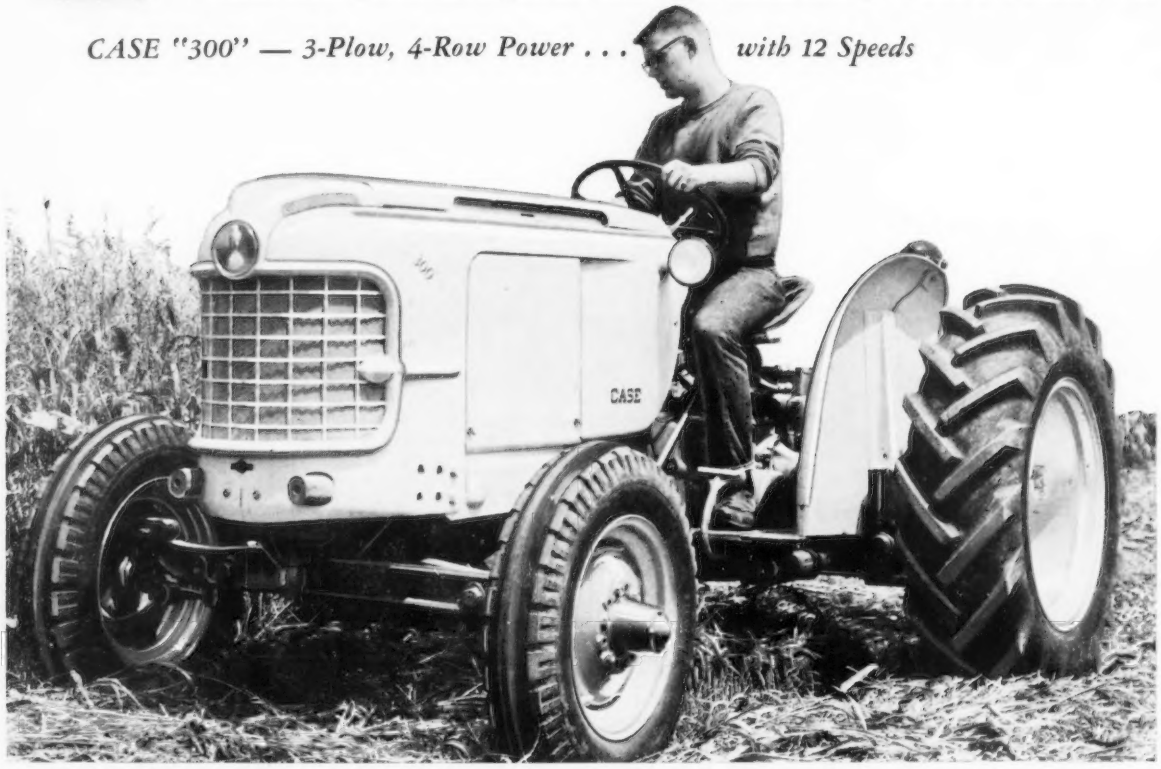
ASAE Winter Meeting • Chicago, Ill., December 9 to 12

THE JOURNAL OF THE
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Economy in CASE® Tractor Performance Starts 'Way Back Here!

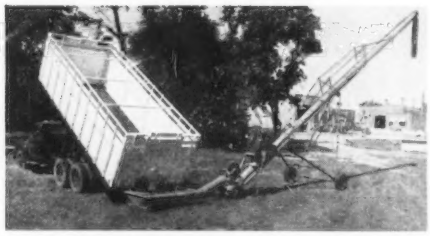
It's the everlasting vigilance of Quality Control that keeps Case Tractor maintenance at a minimum. Superior work efficiency comes from full-torque lugging power from rated RPM down to less than half speed, and transmissions with 8 and 12 speeds that provide a just-right gear speed for every job. Fuel-saving design was proved recently when a Case Tractor broke all records for gasoline economy in official tests! J. I. Case Co., Racine, Wis.

CASE "300" — 3-Plow, 4-Row Power . . . with 12 Speeds



New dry sprayer for granular insecticide . . . *Century Engineering Corporation*

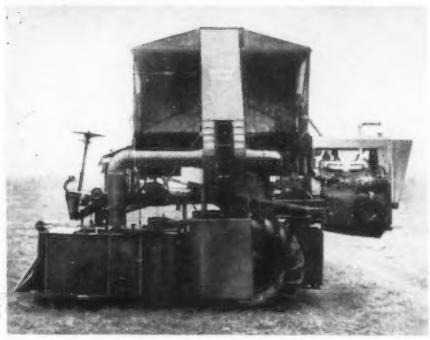
Latest type gas engine drive auger elevator *Kooiker Manufacturing Company*



The Implement Industry looks ahead—with

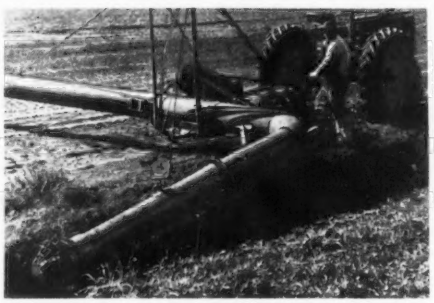
New all-purpose self-unloading side-delivery forage box . . . *Gehl Bros. Manufacturing Company*

Latest model Rust cotton picker . . . *Ben Pearson Incorporated*

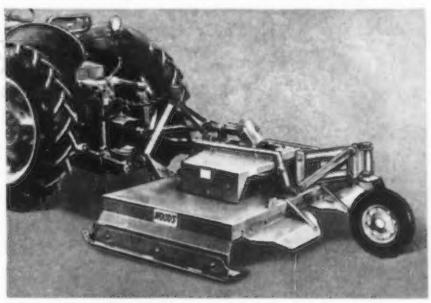


new, ever-better machines powered through

Schmidt one-man portable ditch pump . . . *Blackwelder Manufacturing Company*



New model rotary mower-shredder . . . *Wood Brothers Manufacturing Company*

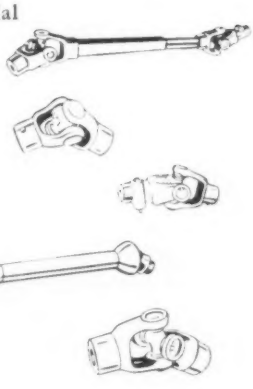


BLOOD BROTHERS Drive Line Assemblies

Some of these implements are new and unique—designed to expedite special or advanced farming methods. Others are improved, more efficient models that cut labor hours to new minimums.

Yet these are just a few examples of *many* ever-better machines offered by a dynamic Implement Industry that is *looking ahead*—to assure healthier profits for dealers and the farmers who buy from them.

Also significant: *All* these models include Blood Brothers Universal Joints and Drive Lines . . . the top-quality components that help *any* implement work better—*sell better!*



FOR FARM IMPLEMENTS, MORE BLOOD BROTHERS UNIVERSAL JOINTS ARE USED THAN ALL OTHER MAKES COMBINED.

BLOOD BROTHERS MACHINE DIVISION

ROCKWELL SPRING AND AXLE COMPANY

ALLEGAN, MICHIGAN

UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

AGRICULTURAL ENGINEERING

Established 1920

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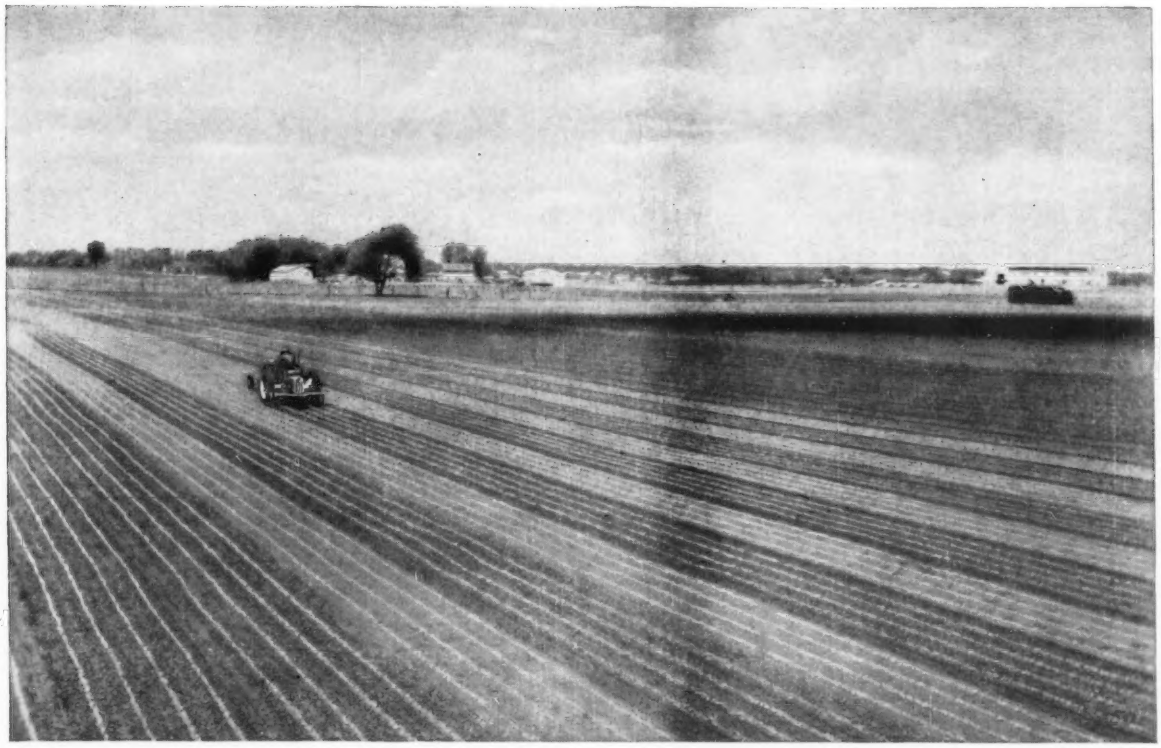


Yes, we have hayseeds in our hair

You don't ordinarily associate Clark Equipment with the business of farming, but we're in it—and in no small way.

On crop acreages, drainage, fertilizers, feeds and the like, we don't pose as authorities; but in the vital area of power equipment, without which modern farming wouldn't be modern, we know what we're talking about.

• A few years ago an implement manufacturer called us in. Said he, in effect—"We know power-farming, you know power transmission. Work with us to design what a tractor drive unit really ought to be."

• We jumped at that—who wouldn't?

Step 1 was to sweep out the rubbish of traditional thinking; and particularly the old idea that a conventional assembly of engine, transmission and axles on a frame constituted an industrial chassis.

Step 2 was to conceive, test and build an axle-transmission driving unit of truly functional design, stripped of every non-essential ounce of metal. That was done.

This intelligent collaboration seemed to us at the time, still appeals to us now, as the best way we know of to build a better machine: this pooling of a manufacturer's operations experience and Clark's half-century of engineering know-how in the basic field of power transmission.

Interesting sequels to that incident are two:

1. Other manufacturers of agricultural and industrial machinery, always alert for constructive ideas, called in Clark engineers — with equally gratifying results.

2. All those manufacturers are still thoroughly satisfied with their Clark Drive Units—and we are just as satisfied with the business of manufacturing them.

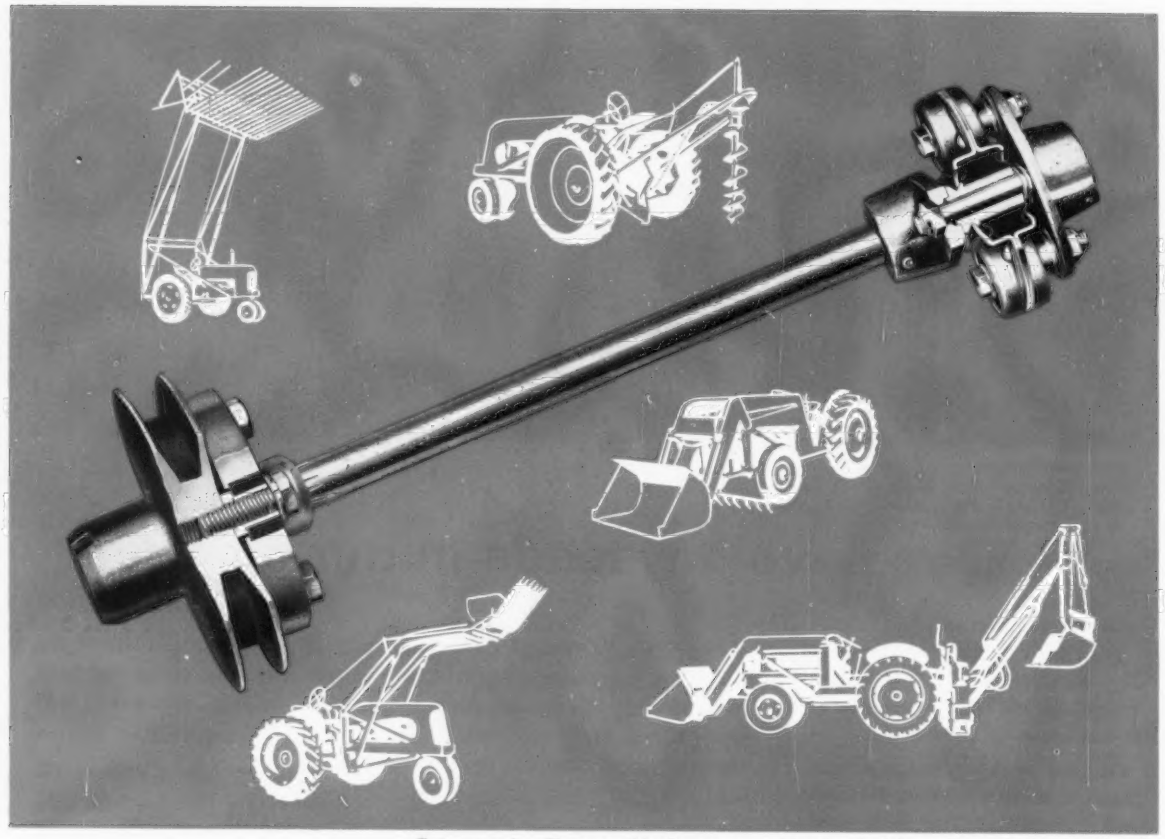
Is there a place at your planning table for Clark's engineering imagination and ingenuity and resourcefulness—for designing a new model or for modernizing a present one? They are yours to command. Let's explore the mutual advantages. A letter will make contact.

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Automotive Division
Buchanan 1, Michigan

The secret behind the Morflex Driveshaft's amazing ability to . . .

end vibration and misalignment problems in PTO Pump Drives



Cut-away view illustrates Morflex neoprene biscuit principle applied at both ends of shaft.

Driveshaft vibration and misalignment of the pump frame support have always been twin bugaboos with tractor power-takeoff drives. They put excess strain on hydraulic pumps and quickly wear out pump bearings.

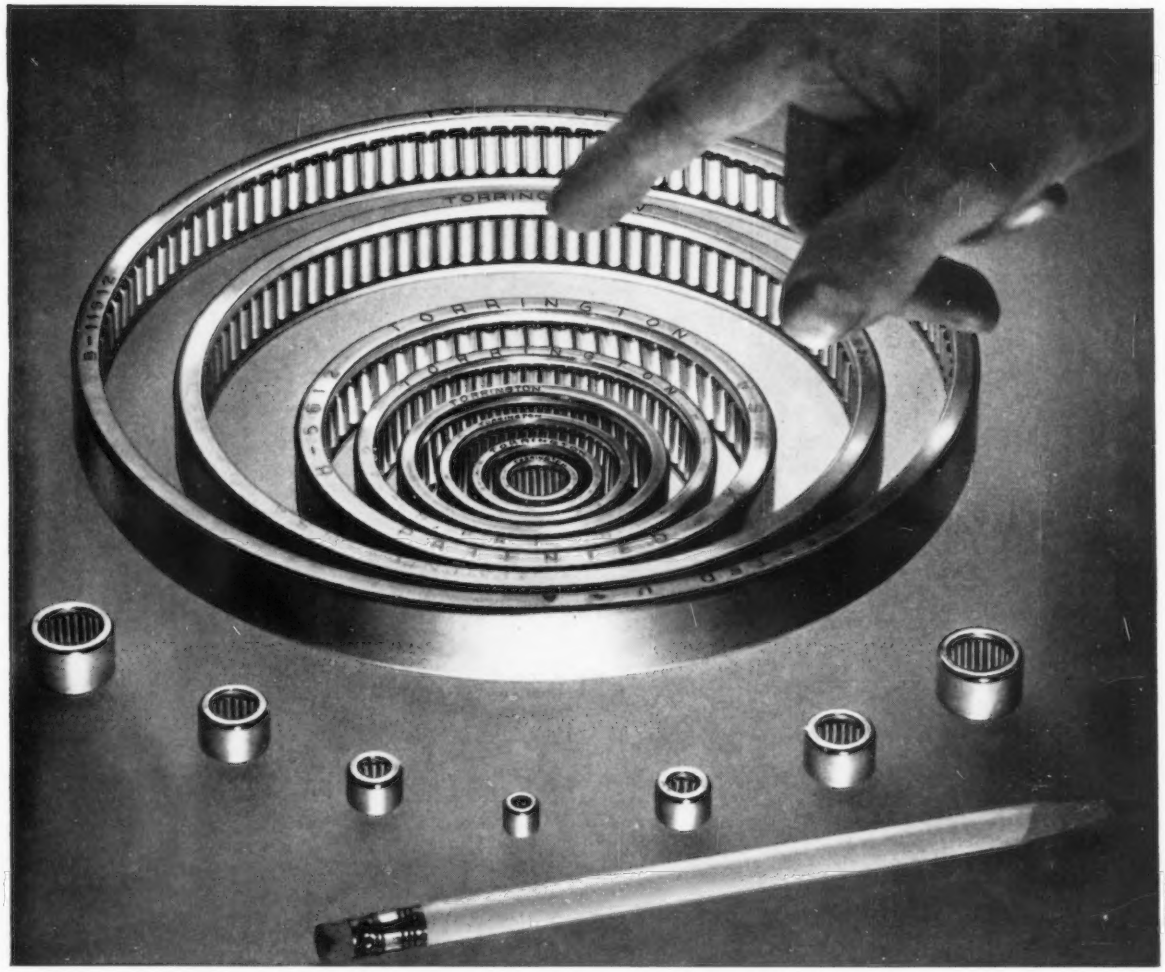
The Morflex Driveshaft solves this problem. Special resilient neoprene biscuits in the driveshaft couplings give unusual torsional flexibility; compensate for all conditions of shaft misalignment: angular, axial, and parallel. The special design of the neoprene biscuits absorbs vibration, provides uniform stress and deflection under all operating conditions.

Unaffected by dust, dirt, water or weather, Morflex Driveshafts are ideal for the roughest jobs. They require no lubrication or maintenance.

Compact Morflex Driveshafts fit limited space requirements; can be designed to fit specifications of mass-produced, tractor-mounted equipment.

If you have a PTO driveshaft problem, it will pay you to investigate Morflex Driveshafts. Phone, wire, or write us today for fast assistance and full details. MORSE CHAIN COMPANY, INDUSTRIAL SALES DIVISION, ITHACA, NEW YORK.

MORSE BW *Trademark **POWER TRANSMISSION PRODUCTS**



TORRINGTON NEEDLE BEARINGS

come in large sizes too!

Meeting the needs of designers for more compact, higher capacity anti-friction bearings in thousands of applications, Torrington Needle Bearings are made in a range of sizes for shafts from ⅛″ up to 7¼″ in diameter. Several widths are available in most sizes to meet different application requirements.

In the large sizes as in the small, basic design advantages are the same. Unit cost is low and radial load capacity is greater than any other anti-friction bearing of the same size.

Large Needle Bearings are doing big jobs in transmissions, steering gears, suspension and starting motors of farm tractors and earth-moving machinery. They have also been used for many years in industrial hydraulic pumps.

To gain the advantages of the unique Torrington Needle Bearing in your product, enlist the knowledge and skill of our Engineering Department.

See our New Needle Bearing Catalog in the 1956 Sweet's Product Design File —or write direct for a catalog.

TORRINGTON NEEDLE BEARINGS
Give you these benefits

- low coefficient of starting and running friction
- full complement of rollers
- unequalled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts

THE TORRINGTON COMPANY
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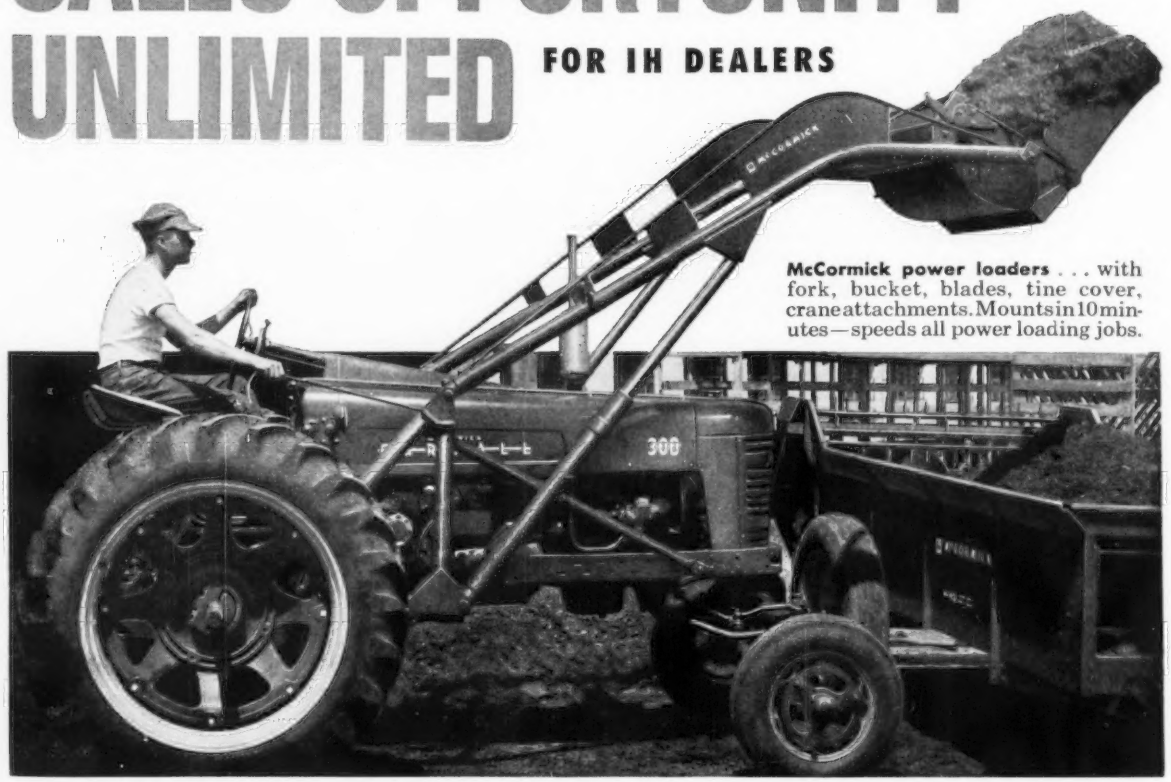
TORRINGTON BEARINGS

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

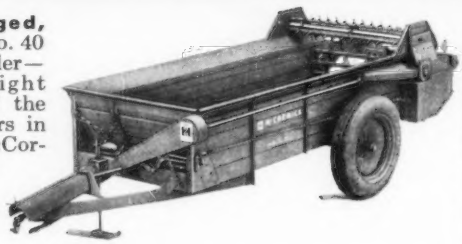
Full line of McCORMICK® chore equipment provides year 'round

SALES OPPORTUNITY UNLIMITED FOR IH DEALERS



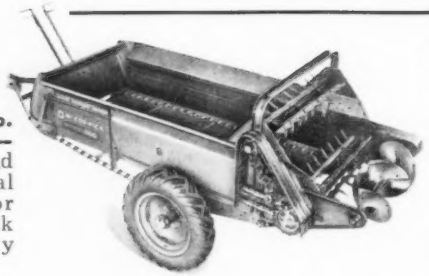
McCormick power loaders . . . with fork, bucket, blades, tine cover, crane attachments. Mounts in 10 minutes—speeds all power loading jobs.

Big, rugged, 140-bu. No. 40 pto spreader—heavyweight champ of the 5 spreaders in the big McCormick line.



McCormick 2 and 4-wheel trailers . . . rugged farm wagons . . . big-capacity boxes and platform for every hauling job.

McCormick No. 10 spreader— 45-bu., ground driven—ideal spreader for smaller stock and poultry farmers.



Handy, Fast-Hitch platform carrier—speeds light hauling jobs, makes every Fast-Hitch farmer a sales prospect!

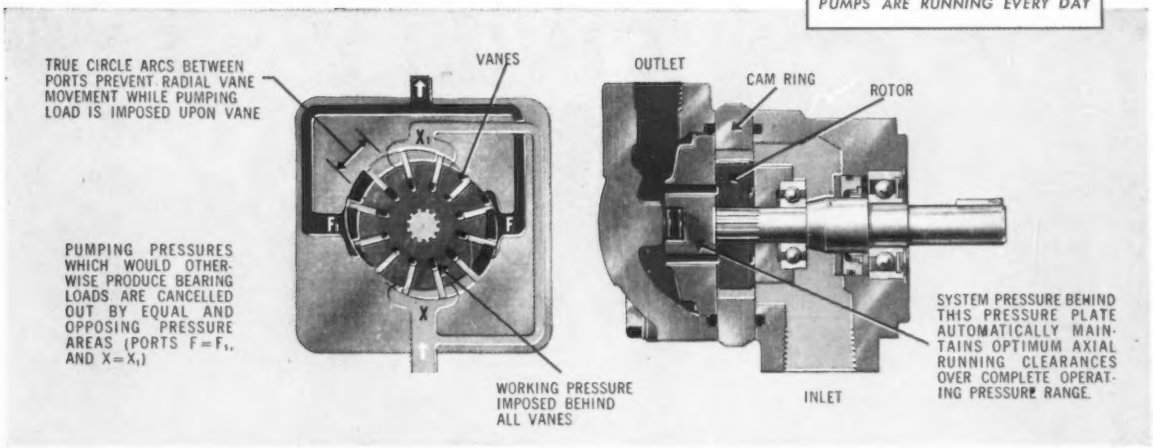
McCormick chore equipment for every prospect! Extensive IH chore line—to match each farm's individual chore needs—creates *sales opportunity unlimited* . . . the year 'round . . . for *every* IH dealer!

INTERNATIONAL HARVESTER

International Harvester products pay for themselves in use—McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Crawler and Utility Tractors and Power Units—General Office, Chicago 1, Illinois.

Question: Why are VICKERS® Balanced Vane Pumps the most widely used oil hydraulic power pumps on mobile equipment?

MILLIONS OF VICKERS VANE TYPE PUMPS ARE RUNNING EVERY DAY


TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
VANES
OUTLET
CAM RING
ROTOR
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F=F1, AND X=X1)
SYSTEM PRESSURE BEHIND THIS PRESSURE PLATE AUTOMATICALLY MAINTAINS OPTIMUM AXIAL RUNNING CLEARANCES OVER COMPLETE OPERATING PRESSURE RANGE.
WORKING PRESSURE IMPOSED BEHIND ALL VANES
INLET

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.

For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (only a few shown below) are *the most widely used of all pumps in oil hydraulic service on mobile equipment.*

The many advantages listed hereafter merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps for construction, automotive, agricultural and materials handling equipment.

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1516 • Detroit 32, Michigan

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IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

OPTIMUM RUNNING CLEARANCES—Both radial and axial clearances are automatically maintained over complete operating pressure range and throughout pump life.

FLOATING ROTOR DRIVE—Rotor is free to float, for correct centering and alignment, on a rigidly supported spline.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

EASIER COLD WEATHER STARTING—At normal engine starting speeds vanes are retracted . . . centrifugal force is insufficient to throw vanes outward into operating position . . . thus no pumping action takes place and pump drag on starting engine or motor is nonexistant. Only after engine starts is speed sufficient to extend vanes and begin pumping.

GREATER INSTALLATION ADAPTABILITY—Various types of mountings and four optional positions of pressure outlet connection. By unbolting and rotating pump head, the outlet can be placed parallel, opposite to or at a right angle in either direction to inlet. Shaft drive is in either direction depending only on internal assembly. Pump can be driven by belt, chain, gear or directly coupled.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

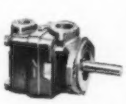
MINIMUM MAINTENANCE—Hydraulic balance . . . optimum running clearances . . . floating rotor drive . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life.

COMPACT—These pumps occupy very little space in proportion to their capacities.

CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin M-5101.

Single pump available in five basic case sizes having 15 normal delivery ratings. Operating pressures to 1500 psi (two largest units to 1000 psi).



Double pump for operating two independent hydraulic circuits from one power source. Available in 38 combinations. Operating pressures to 1500 psi (two largest units to 1000 psi).

"Package" type pump with integral volume control and relief valve, and oil reservoir; also available without oil reservoir. See Bulletin M-5107. (This pump only.)

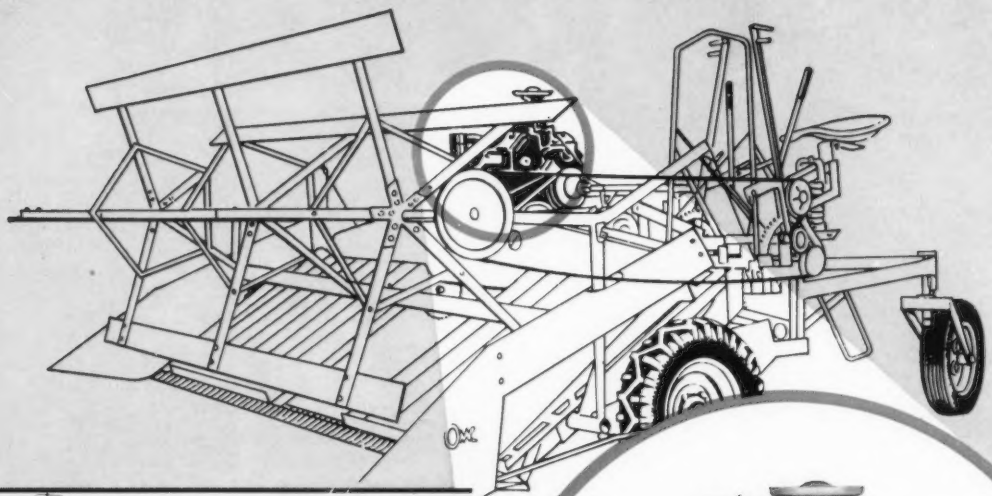
ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

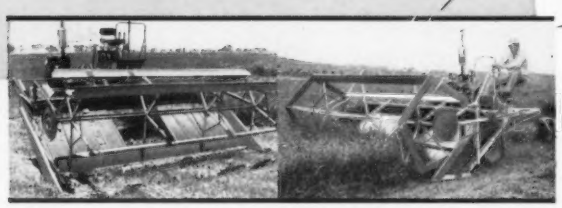
7353

avco Lycoming powers...

the newest advance in farm equipment–

the Self Propelled **WINDROWER!**





Windrower by Hesston Mfg. Co. Windrower by Owatonna Mfg. Corp.

Two of the leading manufacturers of Windrowers, Hesston and Owatonna, realized the advantages that a superior engine would give their unique machines which gather grain and hay with amazing efficiency. That's why both chose the 30 h.p. Lycoming C2-90!

THE
FULL POWER
LYCOMING **C2-90**
rated 30 h.p.
delivers 30 h.p.!

LOOK AT THESE ADVANTAGES:

- Air-cooled—means lighter weight, lower cost, all-weather performance, superior endurance.
- FULL POWER performance—rated at 30 h.p. *delivers* 30 h.p.!
- Highest horsepower and torque per cu. in. displacement in air-cooled field.
- Complete interchangeability—identical mounting and shaft dimensions with other major air-cooled industrial engine units in horsepower range.
- Reliability and simplicity for easy maintenance.

LYCOMING POWER CAN HELP YOU!

The C2-90 is adaptable to a variety of farm equipment applications from forage harvesters to crop sprayers. And, specifically for farm equipment applications, other larger engines are on the way. To find out how 45 years of engine-building experience can help you, write: Sales Engineering, Industrial Engines, Lycoming, Williamsport, Pa.

avco Lycoming **defense and industrial products**

BCA

Standard . . . or custom-made

BCA BALL BEARING PACKAGE UNITS

improve implement performance . . . reduce manufacturing costs

There are two ways in which you can benefit from BCA's long experience in the design and production of pre-lubricated ball bearing package units for farm implement applications.

● Use standard BCA package units on your assembly line.

● Count on BCA for skilled assistance in designing custom-made package units for special applications . . . or for use in new implements you plan to manufacture.

Choose one or the other . . . or both. You will find that you can reduce assembly time and costs . . . improve product performance, too.

BCA packaged units combine the bearing, its housing, and an effective seal in a single rugged unit capable of handling the loads, speeds and operating conditions encountered in farm work. Lubricated for life, standard packaged units are available for many applications including idler pulley assemblies . . . cam followers . . . plunger rollers . . . hay rake bearings . . . grains drills . . . others.

BCA pioneered the development of pre-lubricated package units for agricultural use . . . can help you find the right answers to any ball bearings problem you may have.

BCA

BEARINGS COMPANY OF AMERICA

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

LANCASTER • PENNSYLVANIA

Pioneers of pre-lubricated *package unit* ball bearings for agriculture

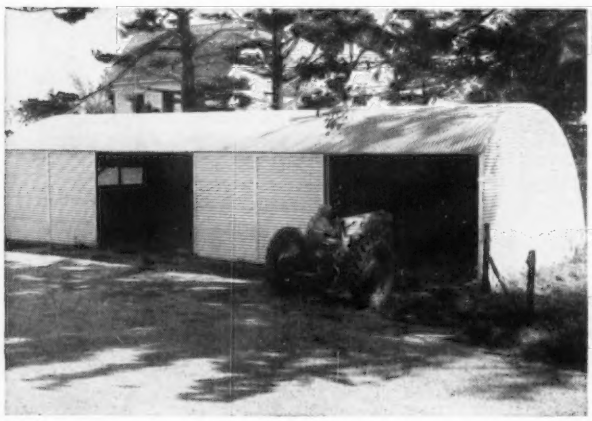
Long live your machinery

HERE IS what we learn from a bulletin issued by the University of Missouri: "The expected life of farm machinery left in the open will be decreased nearly one-third, with greater losses for some types."

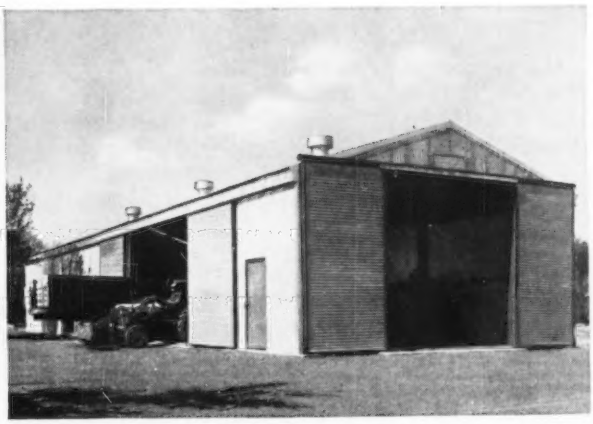
It's easy for any farmer to figure out what this means to him in terms of his own dollars and cents. We warn readers they may be in for a shock, but it is better to face the facts than suffer unnecessary losses.

A few minutes with pencil and paper gives you a reasonably accurate estimate of what is saved by using an all-steel Quonset building to protect your machinery. Just list the machinery on your farm, estimate the value, and take one-third of the total. The amount of your loss, in this day of highly mechanized farming, very likely is enough to pay for a Quonset Machinery Storage Building. Of 1,177 combine-owners surveyed by Kansas State College, 1,032—over 87%!—

The big, easy-working doors enable N. P. Cooper to hurry his tractor, corn picker and load of corn into the safety of his Quonset 32' x 96' building before a sudden rain storm can harm them. Mr. Cooper's farm is located near Robertsdale, Alabama.



Harry McCoy, Dover, Minnesota, farmer, drives his tractor into this gleaming Quonset. Quon-Kote paint, for galvanized surfaces, is available in several colors to harmonize with your farmstead.



All-steel Quonset Rigid Frame 28 farm machinery storage building (28' x 100') on Ekkie Paben's farm near Beatrice, Nebraska. Note the high, wide and easy-operating doors.

said that a machine shed today is a necessary investment.

Farmers themselves were asked to give their ideas on what is required for the best possible machine shed. Of course, good value and easy financing were high on the list; and Quonsets are well known for both. They were quick to specify big interiors, free of obstructions, designed for close-to-the-wall parking; one look at a Quonset shows why the clear, post-free interior satisfies these important requirements. Easy-working doors, wide enough and high enough to accommodate almost any machine, were also widely favored; and Quonset doors meet these specifications. Other qualities desired included weathertightness, fire safety, rodentproofing, and good appearance with a minimum of maintenance; for all these, Quonsets are noted. Quonsets are easy to erect—fast—and this was another popular requirement. On point after point and by farmer after farmer, Quonsets have been proved outstanding.

Although properly housed machines are estimated to need one-third less repairs than machines left outside, all farmers agree that the ideal building should have room for a farm shop.

They specified space where machines can be repaired, overhauled and given preventive maintenance during off-seasons and on rainy days. Thus, with a Quonset machinery center, they can cash in with better performance in the field, as well as save time and unnecessary expense under working conditions that are both convenient and comfortable for even the most difficult jobs.

Getting machines out of the weather is a logical, common-sense objective. And no other building of equal quality gives protection at a more reasonable cost than a Quonset.

There's a Quonset for Every Job on your Farmstead

Stran Steel

STRAN-STEEL CORPORATION

Detroit 29, Mich. • A Unit of

NATIONAL STEEL CORPORATION

56-SS-62-A

A FARM SERVICE CENTER FOR EASY MACHINERY MAINTENANCE

On his Summerdale, Alabama, farm, E. J. Engle uses part of the space in his Quonset to weld a bumper. Farmers prevent break-downs, save field time by making repairs in their Quonsets.

E. G. Miller, Valleyford, Washington, has a machine service shop in his Quonset that helps him save time and expense while getting better performance.

"Keeping equipment in repair is easy in my Quonset," says Russell Ridge, Albany, Ga. "Tools are handy and it's always comfortable working inside."

ONE OF A SERIES . . .

What makes a cylindrical roller bearing good?

WELL-MADE, VERSATILE OUTER RACES

Outer races are vital parts of all roller bearings, except where housings can provide hardened and ground operating surfaces. In housings of aluminum, cast iron or un-heat-treated steel, outer races assure a dependable roller pathway.

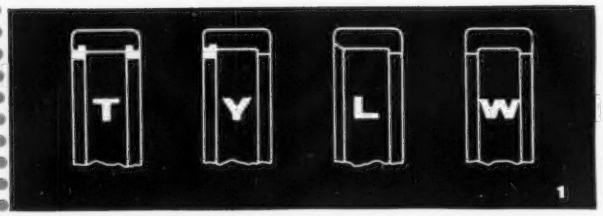
While the outer race is not normally the critical member of the bearing, it can still suffer fatigue failure, like all objects subjected to stress repetitions. Therefore HYATT outer races are manufactured with the same scrupulous care that we apply to inner races and all other components of HYATT Bearings. We supply a wide variety of outer races, which makes HYATTS versatile enough to fit practically any design requirements. Some of these application and operating advantages are briefly covered at the right.

You'll find more details in HYATT General Catalog No. 150, or your nearby HYATT Sales Engineer will gladly help you choose the type best suited to your needs. Remember, HYATT is America's *first* and *foremost* maker of roller bearings. Hyatt Bearings Division of General Motors, Harrison, New Jersey.

GM GENERAL MOTORS

HYATT

ROLLER BEARINGS

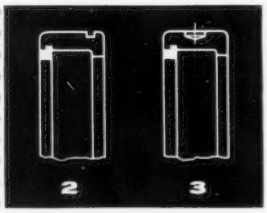


1. OUTER RACE TYPES

HYATT Hy-Load outer races are available in a variety of standard configurations (Figure 1). W, L and Y races have solid flanges, which sustain light or intermittent thrust loads. T and Y races with internal snap rings have equal radial load-carrying capacity but are not recommended for applications under continuous thrust. T, Y, L and W races may all be mounted using roller ends against the solid shoulder or internal snap ring for purposes of locating the outer race axially.

2. CIRCUMFERENTIAL LOCATION

An ample choice of outer race locating methods may be used with HYATT Hy-Loads. Circumferential location is often by a press fit. (Generally the rotating race should be applied with a press fit and the stationary race with a push fit.) When a push fit is used, axial clamping against the race ends provides satisfactory circumferential location. Positive circumferential location is provided by an outer race dowel.



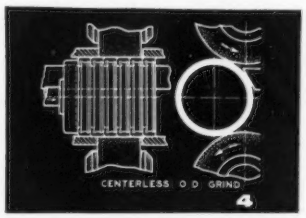
3. AXIAL LOCATION

Axial location of an outer race is usually by pressing or pushing the race to a housing shoulder. The race may be prevented from "walking out" of the housing bore by the flange or snap ring operating against the roller ends. Axial clamping against a housing shoulder or snap ring provides positive axial location. However, if a shoulder is not available in the housing, an auxiliary holding device such as an external snap ring or an outer race dowel is needed. HYATT Hy-Load Bearings can be supplied to original equipment builders with outer races having a snap ring groove (Figure 2) or a blind dowel hole (Figure 3), at moderate increase in cost.

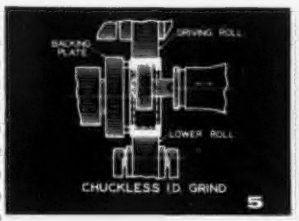
4. OPERATIONAL REQUIREMENTS

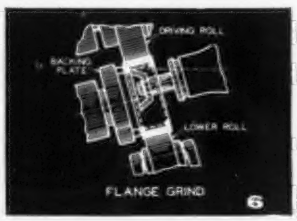
Quality controls are rigidly applied to all HYATT outer races to maintain: a. Minimum wall variation; b. minimum runout of race ends to bore; c. minimum runout of race flange inner faces to bore; d. minimum pathway and outer diameter taper; e. minimum outer diameter tolerance.

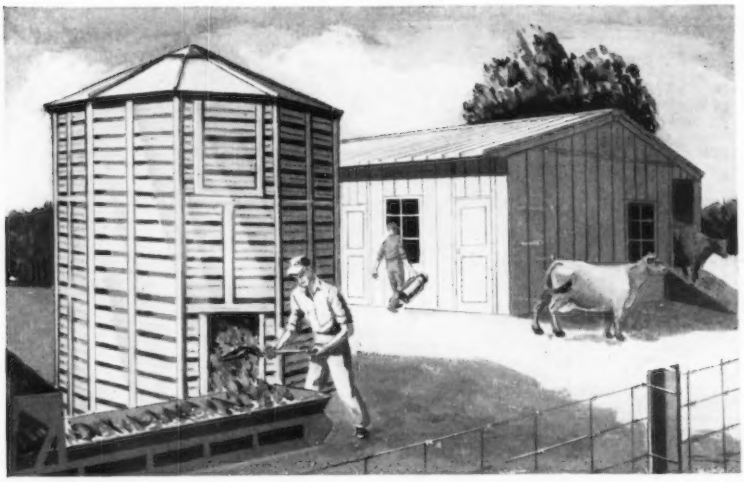
5. MANUFACTURING PROCEDURES



After careful primary machining and heat treating, ends are faced off square and parallel by a double end grind. This provides a reference surface from which all runouts and squareness can be gaged. Outer race diameters are generated by the centerless grinding method to provide an O.D. with as little out-of-round as practical. The through-feed method is a valuable economy (Figure 4). Next, the pathway (or race I.D.) is ground centerless, generating a cylinder concentric with the O.D. cylinder, by driving the race on the O.D. and positioning the grinding wheel relative to the drive roll (Figure 5). Finally, flanges are ground using the race ends as a reference. The result is a race of as nearly perfect geometry as is practical (Figure 6). Critical final inspection completes the procedures.







Armco ALUMINIZED STEEL Type 2 keeps buildings cooler in summer, giving greater comfort and increasing livestock production.

Only Armco ALUMINIZED STEEL

Gives Farm Buildings ALL These Advantages

For prefabricated farm buildings of all types—animal shelters, cribs, grain bins, machinery storages—more and more agricultural engineers are specifying Armco ALUMINIZED STEEL® Type 2. The reason is that only this special steel gives *all five* of these advantages.

1. CORROSION RESISTANCE . . . Seventeen years of testing show that the aluminum coating on Armco ALUMINIZED STEEL lasts at least three times as long in atmospheric service as coatings on commercial galvanized steel.

2. REFLECTS HEAT . . . ALUMINIZED STEEL reflects approximately 80% of radiant heat. This means increased production from livestock because buildings are cooler in summer. It also means less grain loss from insect damage and general deterioration caused by heat.

3. REDUCES HAZARDS . . . Armco ALUMINIZED STEEL is a two-in-one metal. It combines the strength of steel with the corrosion resisting and heat reflecting properties of the aluminum coating. ALUMINIZED STEEL is 10 times stronger than aluminum at 800 F. In case of fire, this could be the difference between losing or saving a valuable building, or an adjoining one. And because of its extra strength, ALUMINIZED STEEL buildings resist damage from wind, hail, farm animals, and accidental collisions by equipment. They stay tight and rigid, give longer service life.

4. COSTS LESS . . . Although ALUMINIZED STEEL costs slightly more than commercial galvanized steel, it costs less than galvanized plus one field coat of paint. Thickness for thickness, it costs less than aluminum. In addition, the extra strength of ALUMINIZED STEEL usually permits gage reductions over aluminum for even greater savings.

5. EASY TO FABRICATE . . . This special steel withstands moderate brake- and roll-forming operations, including Pittsburgh lock-seam in 20 gage and lighter. It can be cold bent 180 degrees over a diameter equal to twice the thickness without flaking or peeling the coating.

Why not let these sales advantages work for you by specifying Armco ALUMINIZED STEEL Type 2 for the prefabricated farm structures you design? For complete information on ALUMINIZED STEEL in farm buildings, just fill in and mail the coupon.

Heat reflectivity and corrosion resistance of Armco ALUMINIZED STEEL Type 2 make grain bins last longer, reduce grain loss.

Sizes and Gages	
Coils	Up to 38" Wide
Sheets	Up to 38" x 192"
Gages	14 Ga. through 24 Ga.

Armco Steel Corporation
2036 Curtis Street
Middletown, Ohio

Send me information on Armco ALUMINIZED STEEL Type 2 for farm buildings.

We manufacture_____

Name_____

Street_____

City_____ Zone____ State_____

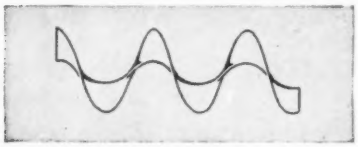
ARMCO STEEL CORPORATION

2036 CURTIS STREET, MIDDLETOWN, OHIO

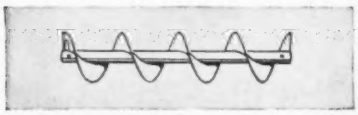
SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

Flexible in application . . . versatile in operation

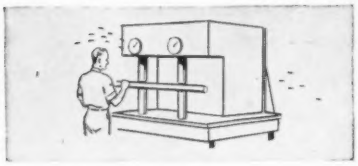
Link-Belt augers simplify design



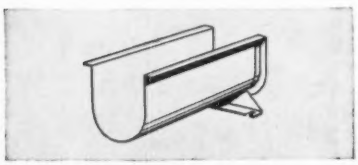
SELECTED FLIGHTING for all your auger needs. Helicoid, sectional or a range of other types of flighting are available in the metal and finish best suited for your design.



SIMPLICITY OF CONSTRUCTION and sturdy design of Link-Belt augers provide dependable, efficient operation on your machine. One basic assembly with no other moving parts to break down.



YOUR CHOICE OF METALS answers your requirements for handling corrosive or abrasive materials. And Link-Belt uses only specially selected steels to assure a uniform product.



ALL COMPONENTS — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, drives —are available for every design.

ENGINEERING SERVICES. Our auger specialists will help you analyze your special needs . . . integrate all elements of your design.

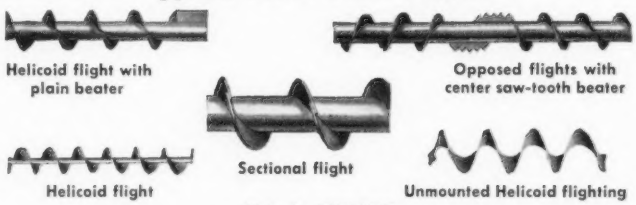
Four Link-Belt auger-conveyors on cotton-stripper provide positive, unobstructed delivery of bolls to kick-beaters. This is just one of the many applications for the full range of augers developed by Link-Belt.

You can be sure of efficient operation, long life and low maintenance when you make a Link-Belt auger part of your equipment.

Link-Belt has a wide selection of augers, many of a specialized design, in a full range of diameters, gauges and pitches. They're accurately made to assure easy assembly, smooth, dependable operation. In addition, all components can be adapted to your particular design.

Whether it's a new application for your present machines or an entirely new concept, simplify your design problems by specifying Link-Belt augers. Call your nearest Link-Belt office for complete information.

Typical LINK-BELT augers



Write for LINK-BELT Screw Conveyor Book 2289

LINK-BELT

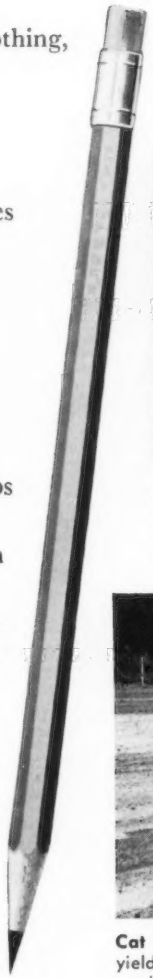
FARM MACHINE AUGERS

14.057

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

Check the Soil Conservation Practices Approved for your county . . .

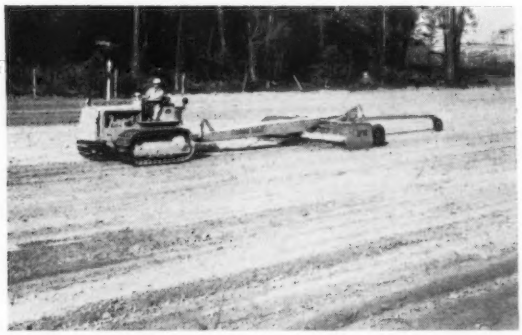
- ☐ Establish sod waterways by smoothing, preparing seedbed, seeding
- ☐ Build terraces
- ☐ Dig drainage and irrigation ditches
- ☐ Build tile outlets
- ☐ Dig ponds
- ☐ Level or shape land
- ☐ Improve contoured intertilled crops
- ☐ Establish strip cropping program
- ☐ Develop pasture including clearing, grading, filling, seedbed preparation, seeding
- ☐ Improve forest by clearing brushland, fencing, tree planting, seeding down legumes, pasture renovation
- ☐ Plow, till, subsoil land deep



A CAT* DIESEL TRACTOR

says, "CAN DO"! to them all!

Earthmoving is a specialty of Cat Diesel Tractors. Here's traction and power to build ponds, ditches, terraces, landscape your building site, earn extra money doing custom work. Ideal for land forming, pulling scrapers and bulldozing.



Cat Diesel Tractor and plane form fields to increase crop yields, improve water distribution. Plant, cultivate, germinate seeds, irrigate more uniformly.

Farm work too tough for ordinary tractors is a push-over for a Cat D2 Tractor. Equipped with a "Swing-Around" Tool Bar, it handles chisels, subsoilers, cultivators, disk ridgers and many other tools designed to speed your hardest jobs.

FREE FARM POWER ANALYSIS . . . *before you plan your next soil conservation program, check with your Caterpillar Dealer. He will help you plan a power program to match your long-term conservation program. See him today! Ask him for your free booklet, "Land Clearing with Cat-built Equipment," or write Dept. AE96, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.*

CATERPILLAR*

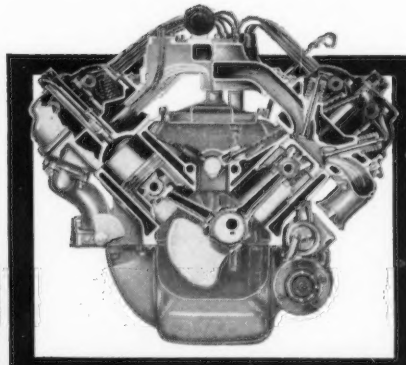
*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

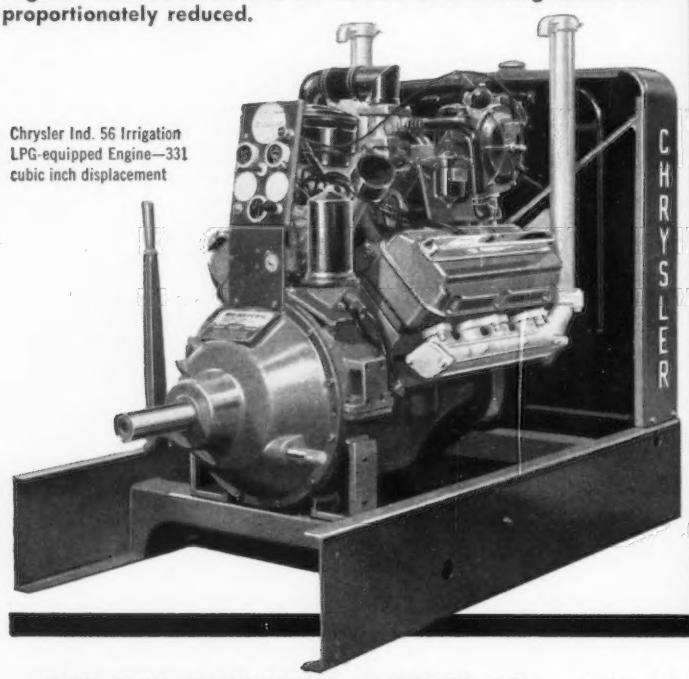
POWER TO PUT CONSERVATION INTO PRACTICE

SHORT-STROKE

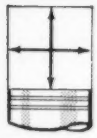
for greater power and lower operating cost

Chrysler Irrigation Engines are over-square, short-stroke V-8 engines built around the famed Chrysler Hemispherical-Design Combustion Chamber (right). Over-square pistons (see illustration) travel only half as far and fast as those in competitive engines. Friction losses are cut in half and bearing loads are proportionately reduced.

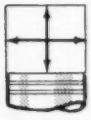




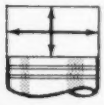
Chrysler Ind. 56 Irrigation LPG-equipped Engine—331 cubic inch displacement



under-square
SMALLER BORE THAN STROKE



square
SAME BORE AND STROKE



Chrysler over-square
LARGER BORE THAN STROKE

CHRYSLER IRRIGATION ENGINES ARE factory-designed and built industrial engines, factory-equipped with industrial heavy-duty equipment . . . components such as forged-steel, induction-hardened crankshaft in combination with tri-metal crankshaft bearings, twin concentric stainless steel valve springs, extra-hard stellite exhaust valve faces and valve seat inserts, positive rotation exhaust valves.

Over-square piston construction reduces friction to a minimum. Results: an amazingly powerful engine, an engine with remarkable efficiency, a cooler-running engine, an engine capable of sustaining top performance in continuous operation.

If this sounds like the kind of engine you want powering your irrigation system, then by all means see your irrigation equipment dealer or the neighboring Chrysler Industrial Engine Dealer. If you prefer, write: Dept. 000, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.

HORSEPOWER WITH A PEDIGREE

CHRYSLER INDUSTRIAL ENGINES

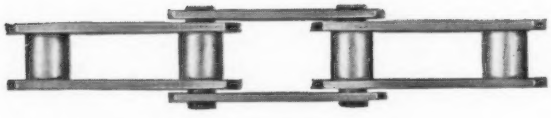
INDUSTRIAL ENGINE DIVISION • CHRYSLER CORPORATION

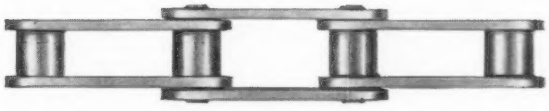
fills the gap
in
implement
chains

Steel
Detachable Chain

ASA Double Pitch
Roller Chains

Low-Cost Answer to the Designer's Dilemma
New Series "A" and "A-R" Chains by Chain Belt





Fills the gap in implement chains. Looking for chains that are lower in cost than double-pitch roller chains... yet assure the quality performance you want? Here's your ideal answer—NEW Rex "A" and "AR" Series Implement Chains. They're lower in cost... yet provide long-lasting service in many applications formerly requiring ASA double-pitch roller chains.

The Rex "A" Series Chain is similar in appearance and in general application to ASA double-pitch roller chains and will operate over the same sprockets. It is *substantially* lower in cost and is somewhat lower in fatigue strength and tensile strength. Hot rolled steel side plates are used and manufacturing tolerances are not quite so close. For many applications, this new chain will assure completely satisfactory service.

New Rex® "AR" Series Chain is a stronger, longer-lasting chain than the "A" Series. Because of its larger diameter pin, the wear resistance of the chain is increased. A heavier bushing provides protection against chain joint stiffness. Increased clearances between working parts enable "AR" Series Chain to accommodate greater misalignment. Actually, in certain applications, this chain will outperform ASA double-pitch roller chain, yet is lower in cost. And it will operate over ASA double-pitch sprockets and has been designed to operate over cast tooth sprockets. In addition, due to its greater strength and wear resistance, smaller sizes can frequently be used—an important cost-saving feature.

Get all the cost-saving facts on these new chain developments and on new "HF" (High Fatigue Strength) Steel Detachable Chain... see how they fill the gap in implement chain selection. See your CHAIN Belt Field Sales Engineer or write CHAIN Belt Company, 4680 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY
Milwaukee 1, Wis.

IN 9 CASES OUT OF 10
the Gauges Are Made By Rochester

And odds are they will give him accurate indications of generator current, temperature, fuel level and oil pressure for the life of his tractor. Such is the record of RMC engine gauges . . . *9 out of 10* major tractor manufacturers use one or more of these dependable instruments consistently.

These same RMC gauges are also used extensively on stationary engines, along with the RMC pressure switch, in irrigation and water supply systems. Built to withstand shock and vibration, and hermetically sealed against dust and moisture, these instruments will always be found where performance requirements are high and the going is rough.

Look to RMC for Full-Line Instrumentation

PRESSURE GAUGES
Illustrated here is a heavy-duty water pump gauge. Sealed from dust, and moisture proof. What are your pressure gauge problems?

FUEL GAUGES
Illustrated here is a tank-mounted fuel gauge with magnetically driven pointer. Head pressure tight to tank contents. Sealed against dust and moisture. What are your fuel gauge requirements?

Manufacturers: TELL US YOUR REQUIREMENTS FOR DIRECT MOUNTING AND REMOTE INDICATING INSTRUMENTS, AND LET RMC ENGINEERING SKILL PROVIDE THE ANSWERS!

Sold Only As Manufacturer's Original Equipment.

RMC

"You Can Rely On Rochester"

LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

ROCHESTER MANUFACTURING CO., INC.
99 ROCKWOOD STREET • ROCHESTER 10, N.Y.

Mr. Matt Huber shows off his 129 Fertilizer Distributor.

USS COR-TEN High Strength Steel

increases strength, reduces weight, decreases corrosion in Fertilizer Distributor

The J. I. Case Company, Racine, Wisconsin, is a long-time manufacturer of farm equipment. A great deal of experience lies behind the choice of USS COR-TEN High Strength Steel for its new fertilizer distributor. USS COR-TEN Steel is used in the hopper of the 129 Fertilizer Distributor to give it greater strength, save weight, and to decrease corrosion from exposure to all kinds of weather. When the long, narrow hoppers are filled with heavy fertilizer, a heavy stress is put on the hopper as it is pulled across rough, uneven fields. The use of USS COR-TEN Steel eliminates considerable additional bracing and framework which would be necessary if USS COR-TEN were not used.

Mr. Matt Huber, farmer, Ellison Bay, Wisconsin, is an enthusiastic user of the 129 Fertilizer Spreader. "The two other fertilizer distributors I owned were heavy, bulky and difficult to handle. All that is solved with my new, lightweight 129 Distributor. USS COR-TEN Steel plays the big role in giving rugged performance with less dead weight. I expect this distributor to last at least 20 years, and I like the fact that maintenance is no trouble at all."

USS COR-TEN, a high-strength low-alloy steel, has a yield point 1½ times that of regular carbon steel, has 4 to 6 times the resistance to atmospheric corrosion, has 50% higher fatigue strength and offers superior resistance to abrasion and impact. For more information on this quality steel, and its applications to farm equipment of many types, contact the nearest District Sales Office of United States Steel. Just ask for a free booklet on USS COR-TEN Steel.

NOW AVAILABLE!

Our "Design Manual for High Strength Steels" contains comprehensive and practical information that you will find extremely useful in designing your product for greater economy and efficiency by the sound use of high strength steels.

For your free copy, write on your company letterhead, giving your title or department, to United States Steel Corporation, Room 5446, 525 William Penn Place, Pittsburgh 30, Pa.

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USS COR-TEN High Strength STEEL

USS

UNITED STATES STEEL

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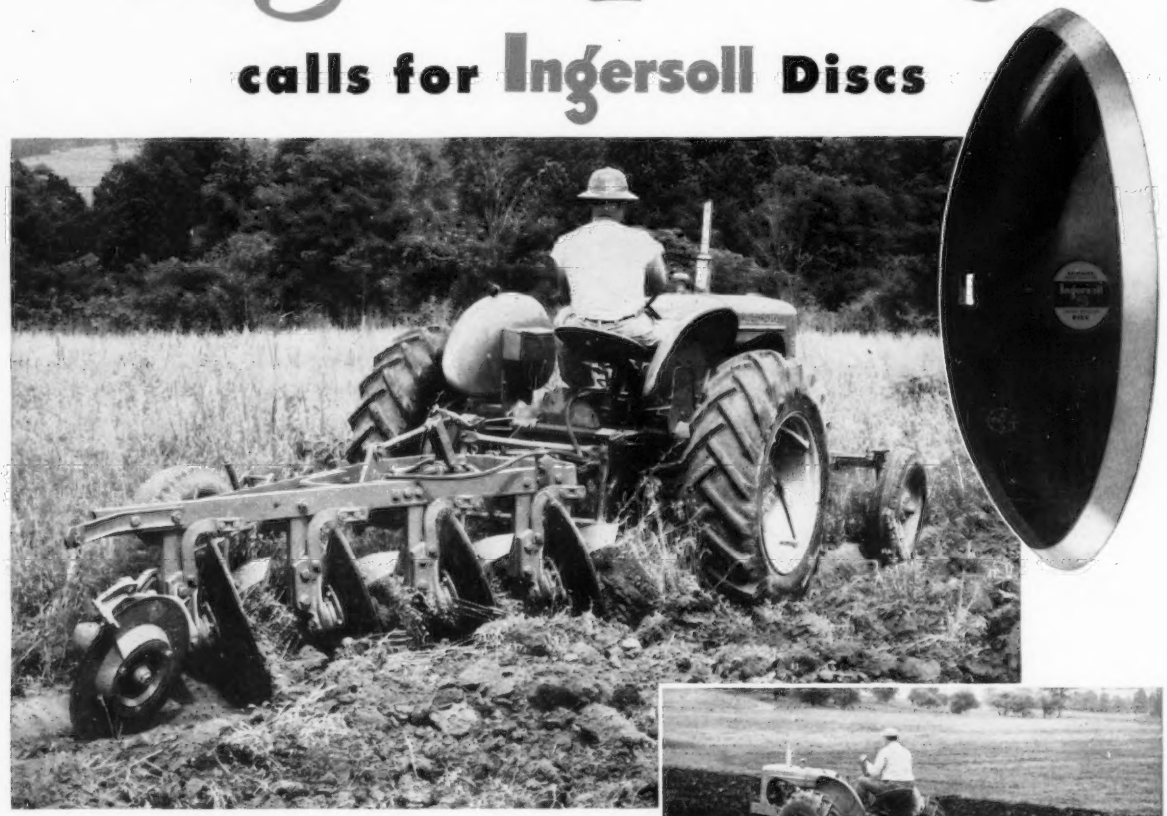

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AGRICULTURAL ENGINEERING

VOL. 37 SEPTEMBER, 1956 No. 9

Draft Measurement for Tillage Tools

Baba Telischi, H. F. McColly and Earl Erickson
Assoc. Member ASAE Member ASAE

A theoretical analysis shows promise as means for determining draft requirements of tillage tools

DESPITE improvement of the shape, material, and operation of tillage tools in recent years, the tillage operation continues to consume a large percentage of farm power. It is estimated that tillage work requires about 30 percent of the total farm draft work (1)* and that more than one-half of this is used in the basic operations of plowing and disking.

Previous Investigations

Many scientists and engineers have studied various aspects of tillage but more basic work needs to be done on the problem. The subject of force and energy measurements in tillage can be divided into two sections; the work of the agricultural engineers, and the cooperative work of agricultural engineers and soil physicists.

The work done by agricultural engineers consists of studies of forces and force components existing in different tillage tools during operation, the design and development of instruments to measure these forces, and measurement of energy required to operate the tillage tools. References 2 to 12 represent only a partial list of work that has been done.

The cooperative work of soil physicists and agricultural engineers covers the study of physical properties of soil and their effect on the draft requirements of tillage tools. Nichols (13) and co-workers have done extensive research on the dynamic properties of soil and their effect on the design of tillage tools. Most of these investigations were conducted in the laboratory.

Objectives

The problem of the force of soil resistance to the various tillage implements and the factors that affect this force of resistance established the following objectives for this article:

- To determine by means of field tests the draft requirements of different tilling methods
- To determine by means of laboratory tests the relationships between the draft requirements of tilling implements and the various affecting factors
- To develop a theoretical method for predicting the results of field tests on the basis of laboratory experiments
- To derive an equation to show the relationships between the force of soil resistance against the tillage tool and the affecting factors.

Investigation of Factors Affecting Draft

A study of factors affecting draft requirements requires a determination of the variables and the relationships between them. The variables that exist in the tillage operation can be divided into three sections—soil, implement and others.

Soil variables include:

- Particle size distribution, including the type of colloidal material.
- Chemical composition, including the effect of organic matter.
- Moisture percentage.
- State of compaction or bulk density.
- Soil structure, including soil cementation effects.
- Effect of vegetation and crop residues.
- Effect of slope of soil.

Implement variables include:

- Kind of implement.
- Kind of metal.
- Surface condition and sharpness of the implement.
- Bearing area against the soil.
- Curvature and the shape of surface applying force.

Other variables include:

- Speed.
- Width and depth of the furrow.

Some of the factors have not been evaluated to date, such as the effect of vegetation. Others have been proved to be negligible, such as slope of the field. Therefore, only the factors that are significant and which can be evaluated presently will be discussed.

In the design of tillage tools, attempts have been made to specialize the implements to work in particular conditions. Successful design not only improves the quality of tilth, but also decreases the draft requirement and eliminates some variables. As an example, the selection of optimum curves of plow moldboards for use in sod, clay, and sandy soil can be mentioned.

Major factors affecting the draft—The common functions of tillage are: cutting loose of the furrow by compression

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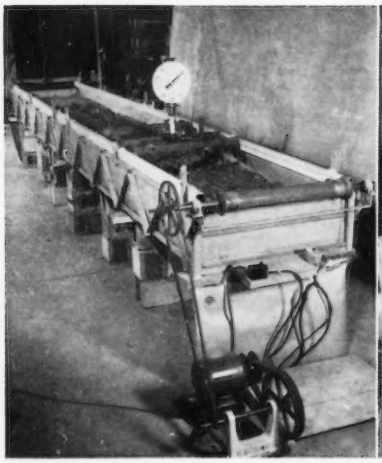
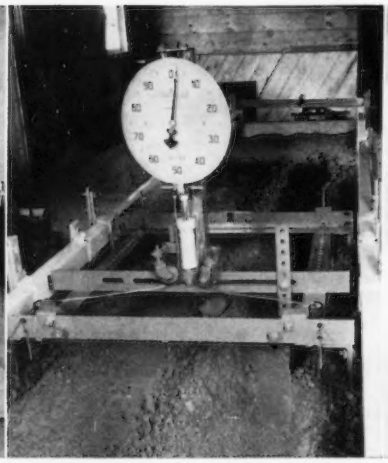
The authors—Baba Telischi, H. F. McColly and A. E. Erickson—are, respectively, former graduate research assistant in agricultural engineering, professor of agricultural engineering, and associate professor of soil science, Michigan State University.

Acknowledgment: The authors express appreciation to W. M. Carleton, professor of agricultural engineering; and in particular to C. O. Harris, head, department of applied mechanics, Michigan State University, for his review of the dimensional analysis theory application in this paper.

*Numbers in parentheses refer to the appended references.





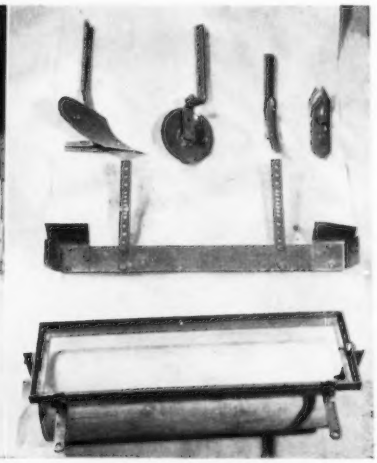


Fig. 1 *(Left)* General view of soil box showing variable speed drive, cable-and-drum type implement carriage and dynamometer • Fig. 2 *(Center)* Detail view of implement carriage showing method of mounting tillage member, and the hydraulic damper on the dynamometer • Fig. 3 *(Right)* Implements used include 4-in plow, 7-in disk, 1-in chisel, 2-in chisel, scraper for leveling, and packer with angle iron weight frame

and shear; and inversion of the soil and covering of trash by pushing the soil up and over a curve.

On the basis of these functions, the variables that affect draft are: resistance to compaction, shear, friction, compression, cohesion, adhesion, and speed. These variables are functions of the following factors: composition and percentage of colloidal content, moisture percentage, bulk density and the speed of the implement. Therefore, only the percent clay, the percent moisture, the bulk density and the speed of the implement were considered in the study. An attempt was made to determine the Atterberg constants but this was not possible in non-plastic soils.

Field Tests

Extensive field tests were conducted to measure the draft requirements of five tilling methods in three different soil types. The percent of clay, percent of moisture, bulk density, speed of implement and the Atterberg constants were measured in different sections of each plot. Even though the test sections were only 10x20 ft the variability of the soil and the inability to control variables discouraged continuation of further field tests.

Laboratory Tests

In order to overcome some of the difficulties encountered in the field tests, it was decided to conduct small-scale tests and theoretical studies. A search of the literature and a study of the work at the USDA Tillage Laboratory at Auburn, Ala., led to the decision to conduct experimental work in a fairly large soil trough in the laboratory.

Dejuhasz and Clyde (14) in 1939 discussed the possibility of using a soil trough to obtain basic information on draft requirements of tillage tools. This idea was considered to be practical and a soil trough 3x20x1-ft was designed and built. The experimental soil trough consisted of three parts: *(a)* the stationary trough that held the soil; *(b)* the moving carrier which held the tillage tools and a spring dynamometer, and *(c)* a power transmission device. Power was transmitted to the carrier by a ¾-hp electric motor by means of a variable V-section pulley, and other necessary transmission parts. Figs. 1, 2 and 3, show the details of the soil trough, implement carrier, dynamometer, power transmission, and the various soil fitting and tillage tools.

The soils used in the experiment were produced by mixing a definite proportion of clay (without organic matter) and washed sand. Soils with 0, 16.78 and 22.52 percent clay were used. A scraper was made to level the soil, a packer for compacting the soil to the desired bulk density, and a sprayer utilized to moisten the soil uniformly. A heavy can-

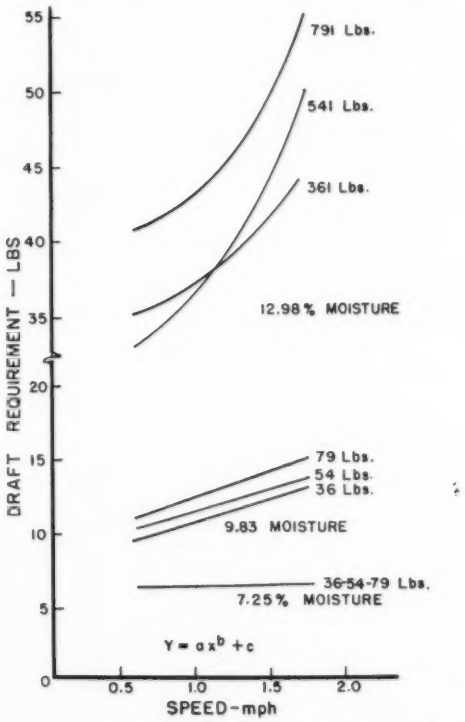


Fig. 4 Speed versus draft requirements of a 1-in tooth pulled 4-in deep in soil containing 22.5 percent clay with three moisture contents and three packing forces. The straight line for 7.25 percent moisture is for all three packing forces.

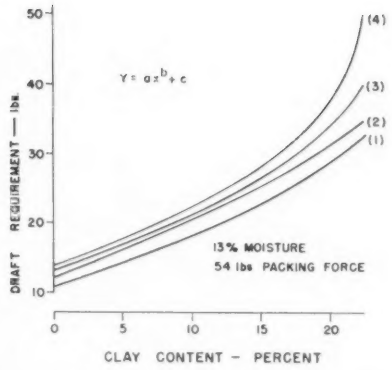


Fig. 5 Percent clay content versus draft requirement of 1-in tooth pulled 4-in deep in soil with 13 percent moisture content, speeds: 0.6, 0.94, 1.29 and 1.77 mph, and 54-lb packing force

vas covered the soil when no tests were being run in order to avoid evaporation and to obtain uniform moisture in the soil.

Tests were run at constant moisture, bulk density, speed, and mechanical composition of soil to obtain basic information about the effects of each of the major factors.

Four speeds of 0.604, 0.938, 1.275, and 1.77 mph were used. The soil moisture levels could not be controlled as closely as the other factors, but after some experiments the approximate amount of water necessary to bring a soil near a definite moisture content could be estimated. Three moisture levels of 7.25, 9.83 and 12.98 percent were employed in the experiments. Packing weights of 36, 54, and 79 lb. were used to vary the bulk density of the soil.

The results obtained were qualitative rather than quantitative, and each of the effects of the different factors were studied separately.

Effect of Speed—The general equation, $y=a\,x^b+c$ may represent the relationship between the speed and the draft requirement of tillage tools, in which y is the draft requirement and x is the speed. (Fig. 4).

In sandy and in any other type of soil where the moisture content is low, the exponent b is nearly zero. The moisture content at which the speed does not have appreciable effect is slightly above the wilting point. As the amount of moisture and clay increases, the slope of the lines increases. In high clay and moisture contents the exponent b will be more than one and the relationship is no longer linear. The factors b and a are related to the clay and percent of moisture and also the shape and kind of implement.

Effect of Clay Content—By clay content is meant the percentage of particles by weight that are smaller than two microns in diameter. The shape of the curve indicating the effect of percent of clay content versus draft requirement (Fig. 5), is flat for low moisture content and speed, and becomes steeper for higher moisture content and speed. The general equation for the curve was $y=a\,x^b+c$ in which y is the draft requirement, and x is the percent of clay and in most cases c is zero.

Effect of Moisture Content—One of the active soil factors affecting the draft in the experiments was soil moisture. However, the effect of moisture was noticeable only when the percent of clay in the soil was high as illustrated in Fig. 6. The moisture versus draft curves rises sharply at the beginning and then flatten at about the moisture content of the lower plastic limit. When the clay content increased the increase of moisture eventually caused a serious puddling of the soil and it was observed that lack of organic matter in the experimental soil caused puddling of the soil at a lower moisture content than in a normal field soil. The limits of moisture variations within which soil was workable for tillage operation narrowed with the increase of clay percentage as shown in Fig. 7. The best equation found to represent the data obtained in all cases was $y=e^{a+bx}+c$.

Effect of Packing Force—The packing force on the soil as applied by the weight on the packer during preparation changed the bulk density of the soil. It seems to be more practical here to show the relationship between the draft and the packing force on the soil than between the draft and the bulk density of soil. The change of draft was proportional to the change of packing force, and this relationship was shown to be a straight line in all cases. The equation of the line is $y=a\,x+b$, where y is the draft, x is the packing force, and a and b are constants depending on the condition. See Fig. 8.

Theoretical Study

As previously discussed, the field tests did not give satisfactory results because of non-uniformity and non-controllability of soil in the field condition. The laboratory method was used to determine experimentally the effects of different factors on the draft requirements of tillage tools. To obtain a general equation to calculate theoretically the draft requirement, a more basic study was considered to be necessary. Dimensional analysis and the theory of models were then employed in a study to obtain a general equation for calculating draft requirements.

From the results of laboratory tests and the work of the previous investigators, it was concluded that clay particles in the soil are the main active element that causes the soil resistance against any implement. Under the conditions of this experiment, clay in the soil was active only when adequate moisture existed in the soil. This emphasizes the importance of the interrelation of clay and moisture as a factor in till-

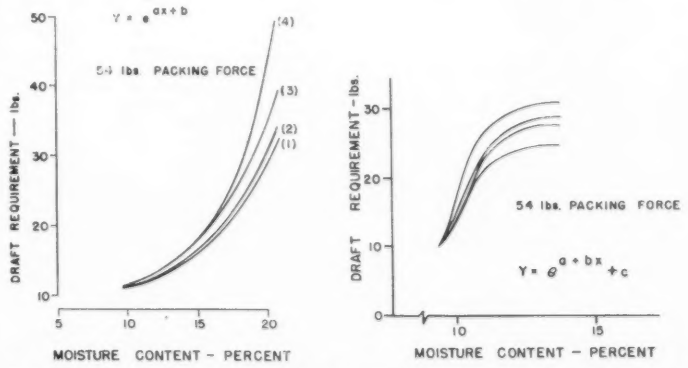


Fig. 6 *(Left)* and Fig. 7 *(Right)* Percent moisture versus draft requirements of a 1-in tooth pulled 4-in deep. Packing force 54 lb and speeds 0.60, 0.94, 1.29 and 1.77 mph. Fig. 6 is in 22.5 percent clay soil; Fig. 7 is in 16.7 percent clay soil

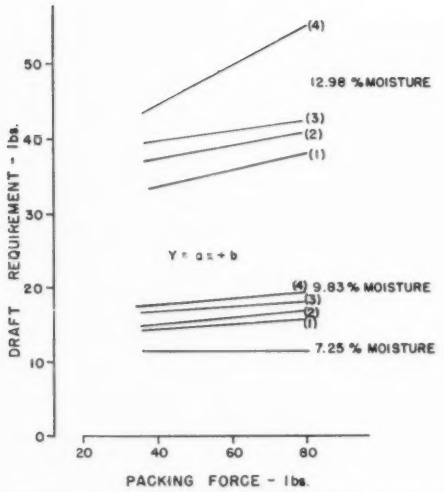


Fig. 8 Packing force versus draft requirements of a 1-in tooth in 22.5 percent clay soil with three different moisture contents, speeds 0.60, 0.94, 1.29, and 1.77 mph. The 7.25 percent moisture straight line is for all speeds

age. Sand and silt, contribute only weight and some surface friction to the system which in laboratory experiments proved to be almost constant.

The application of the theory of dimensional analysis to obtain a theoretical equation for the pulling resistance of tillage tools seemed to be feasible. The theory of models makes possible the application of the results of laboratory tests to field conditions.

The first attempt at the solution of the problem involves a definition of the influencing factors. With the present knowledge of soil characteristics, the elements considered to affect the resistance force against tillage implements were shear, acceleration of soil, velocity of tools, density of soil, a unit of length (which can be of first, second or third power) and viscosity of soil solution or percent of water in soil.

The dimensions of the above factors are:

Shear strength	$S=\frac{F}{L^2}$
Acceleration	$A=\frac{L}{T^2}$
Velocity	$V=\frac{L}{T}$
Density	$\rho=\frac{FT^2}{L^4}$
Force	$Q=F$
Length	$D=L$
Viscosity	$\mu=\frac{FT}{L^2}$

According to the theory of dimensional analysis, it can be said that

$$f(S^a, A^b, V^c, \rho^d, Q^e, D^f, \mu^g)=0 \quad . \quad \text{Equation [A]}$$

According to Buckingham's theorem (15) the equation can be reduced to dimensionless products. The number of those products is equal to the total number of variables minus three (the number of independent variables). To find the dimensionless products, a few assumptions should be made so that each product contains only one of the required unknowns. (Fig. 9).

To find the amount of Q, which is a function of S, D, V, ρ, and μ, the coefficients of A, B, C, and G, should be determined from laboratory data.

In conclusion, it may be said that equation [1], derived in Fig. 9, will indicate the amount of resistance of the soil against the forward movement of the implement. The result will apply to a uniform soil under controlled conditions, as previously discussed. Some of the factors which are not controllable, such as organic matter, vegetation, cementation, etc. have been eliminated. Laboratory investigations are needed to determine the degree of effect of the viscosity and its relationship to the other more easily measureable soil properties.

The work reported here is not a complete solution for the problem of measuring the draft requirements of tillage. The work indicates only the possibility of a theoretical solution with the help of the theory of dimensional analysis.

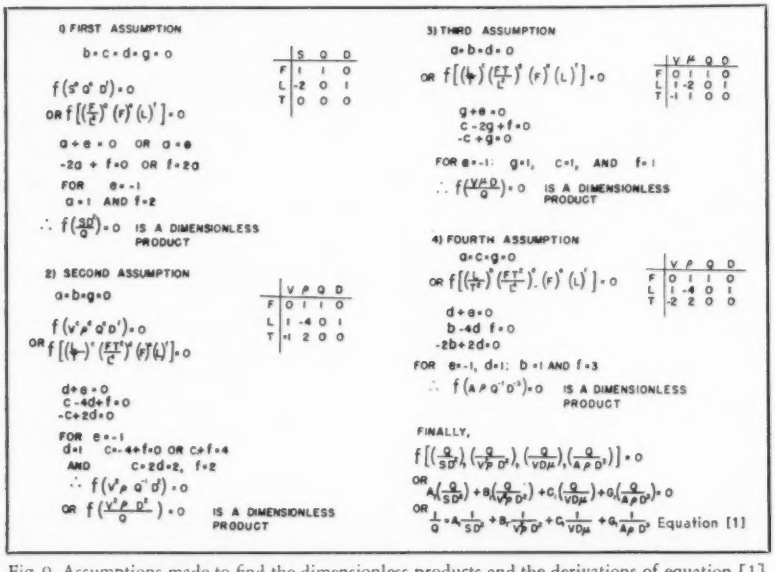

1) FIRST ASSUMPTION
b = c = d = g = 0
f(s^a ρ^d D^f) = 0
OR f[(F/L^2)^a (ρ)^d (L)^f] = 0
a + e = 0 OR a = e
-2a + f = 0 OR f = 2a
FOR e = -1
a = 1 AND f = 2
∴ f(SD^2/Q) = 0 IS A DIMENSIONLESS PRODUCT
2) SECOND ASSUMPTION
a = b = g = 0
f(v^b ρ^d Q^e D^f) = 0
OR f[(L/T)^b (FT^2/L^4)^d (F)^e (L)^f] = 0
d + e = 0
c - 4d + f = 0
-c + 2d = 0
FOR e = -1
d = 1 c = -4 + f = 0 OR c = f = 4
AND c = 2d = 2, f = 2
∴ f(v^2 ρ D^2/Q) = 0
OR f(v^2 ρ D^2/Q) = 0 IS A DIMENSIONLESS PRODUCT
3) THIRD ASSUMPTION
a = b = d = 0
OR f[(1/T)^g (FT^2/L^4)^d (F)^e (L)^f] = 0
g + e = 0
c - 2g + f = 0
-c + g = 0
FOR e = -1: g = 1, c = 1, AND f = 1
∴ f(VμD/Q) = 0 IS A DIMENSIONLESS PRODUCT
4) FOURTH ASSUMPTION
a = c = g = 0
OR f[(L/T)^b (FT^2/L^4)^d (F)^e (L)^f] = 0
d + e = 0
b - 4d + f = 0
-2b + 2d = 0
FOR e = -1, d = 1; b = 1 AND f = 3
∴ f(AρQ^2D^2) = 0 IS A DIMENSIONLESS PRODUCT
FINALLY,
f[(Q/SD^2), (Q/Vρ D^2), (Q/VDμ), (Q/Aρ D^2)] = 0
OR A(Q/SD^2) + B(Q/Vρ D^2) + C(Q/VDμ) + G(Q/Aρ D^2) = 0
OR 1/Q = A 1/SD^2 + B 1/Vρ D^2 + C 1/VDμ + G 1/Aρ D^2 Equation [1]

Fig. 9 Assumptions made to find the dimensionless products and the derivations of equation [1]. Exponents can be checked in equation [A]

Summary

The non-uniformity of soil, and the fact that the control of soil properties in the field is almost impossible, has made field draft tests for tillage implements difficult.

The relationships between the draft requirements and several variables were determined by means of laboratory methods in order to study the draft requirements of tillage tools.

The application of the theory of dimensional analysis to the prob-

(Continued on page 617)

Design of a Flood-Retarding Structure

Joseph Bornstein
Member ASAE

Since the occurrence of severe storms in the northeastern part of the United States during the summer of 1955, interest in flood control and flood prevention has increased greatly. This paper describes the design of a flood detention dam and outlines the procedure necessary for approval and legal authorization for construction

IN THE Northeast one of the more advanced watersheds is Warm Springs Run at Berkeley Springs, W. Va. Two storage dams have already been built, two more have been designed for construction in 1956, and two more will be underway before the end of 1956. In this paper design of the dam at Site No. 3 will be reviewed. It has a 287-acre watershed. Warm Springs Run drains 7040 acres above its outlet into the Potomac River at Hancock, Md.

Preliminary study of the Site No. 3 included a determination of its suitability for storage of floodwater. It was then calculated that a favorable cost-benefit ratio could be expected. The Soil Conservation District negotiated with the landowners for easements to allow work on the detention reservoirs. A geologic investigation was made to check foundation conditions and to locate the material needed for the compacted-earth dam construction. Compacted earth describes the construction because as the earth is placed in the embankment it is rolled with sheepsfoot rollers to a designed compaction. The soils laboratory tested samples to determine the required compaction and other variables which must be known to design a stable earth dam. The field engineers then ran a topographic survey of the area. The geologist determined the expected rate of sediment flow into the proposed reservoir. The hydrologist figured out the likely rates of storm inflow in cubic feet per second and the volume of runoff in acre-feet of water to be stored and discharged.

From these preliminary studies the unknowns are found for design equations. The unknowns include sediment rate, soil strength and weight, and the rates and amount of water to be controlled. At this point of calculations water is flowing off the watershed. Some of it is to be stored temporarily, some is to go out through various spillways. In other words, the basic equation $I=O+S$ (inflow equals outflow plus storage) is in effect. Fig. 1 helps to illustrate this. Here the compacted earth dam (lettered 1) holds back the flood water as it arrives from the 287-acre watershed. Normal pond elevation is set by the 12-in diameter low-stage opening (lettered 2) in the riser (lettered 3). By locating the low-stage opening at elevation 732.5 we leave 5.6 acre-feet of storage space for sediment, an assumed 50-year accumulation. The pipe spillway (lettered 4) controls the outflow, first, through the low stage opening in the reinforced concrete riser; then, as the storage increases to the top of the riser, outflow is over the weir of the riser and control changes to the 30-in diameter pipe (4) of the principal spillway. The principal spillway includes the riser and the pipe conduit.

For Site No. 3 it was found that a riser 3 ft square was needed. The top of the riser was located at an elevation below which the worst storm expected once in 20 years would be stored. The low-stage opening is the only outlet operating until a storm would build up in the reservoir to the crest of the riser. The worst storm expected once in 100 years would use the riser and the excess water would be stored in the pond below the elevation of the emergency spillway. The peak storage of the storms of intermediate frequencies, between 20 and 100 years, would be at stages between the crests of the spillways — the principal and emergency. The latter is an earth spillway. Along with the dam itself, it is seeded to a close-growing turf mixture.

As a safety measure the top of the dam elevation is located to contain the discharge in the spillways when the $I=O+S$ equation is applied to the storm which is called the maximum probable. That is, a portion of the runoff will be temporarily stored in the reservoir while some will be discharging through the principal and emergency spillways. None would go over the top of the embankment.

Structurally, the earth dam has been checked for stability against sliding. It was calculated that the force of the maximum head of water against the dam will not cause it to slide. The pipe through the dam is chosen to withstand earth loads it must support under 45 ft of fill. As shown in Fig. 1, anti-seep collars (lettered 5) and toe drains (lettered 6) have been designed to guard against seepage of water through the dam. The reinforced concrete riser is designed to withstand expected forces. An anti-vortex device (let-

(Continued on page 617)

Paper presented at the meeting of the Pennsylvania Section of American Society of Agricultural Engineers, Pennsylvania State University, April, 1956.

The author — JOSEPH BORNSTEIN — is civil engineer (design), engineering and watershed planning unit (SCS), U.S. Department of Agriculture, Upper Darby, Pa.

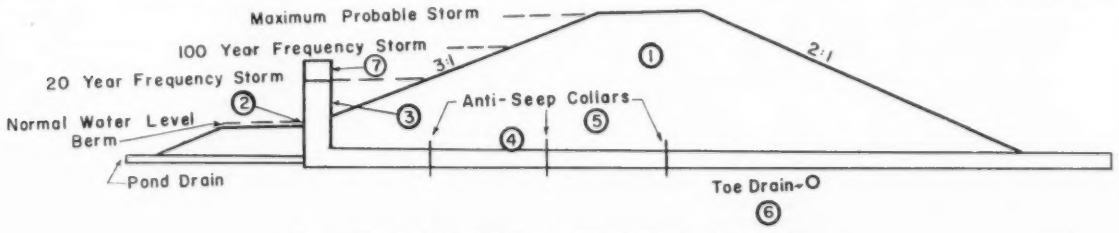


Fig. 1 Details of a flood detention earth dam and principal spillway

An Agricultural Engineering Challenge

Agricultural Product Preparation

Carl W. Hall and Jordan H. Levin
Member ASAE Member ASAE

The authors present a strong case for substitution of the term "product preparation" for the term "processing" so generally used in recent years, and as applied to preparation of a product for market, preservation or use

IN THE last few years the term "processing" has been discussed frequently by agricultural engineers. There are differences of opinion and considerable confusion as to the meaning of processing and where it fits into the profession of agricultural engineering. Due to increased interest and activity in what has been called agricultural processing the time has come when the agricultural engineering profession should decide on a policy in regard to this subject and which will help agricultural engineers plan their work in this important field.

Agricultural Processing Defined

As an approach to the subject the first step should be to answer a few questions. What is an *agricultural engineer?* He is an engineer who applies his talents to agriculture.

What is an *engineer?* Although many definitions are available, essentially he is a person having a knowledge of and the ability to apply fundamental engineering subjects; principally, machines (machine design, power transmission, etc.), material (strength of materials, statics, etc.), hydraulics (drainage, irrigation, etc.), electricity (alternating and direct current, electronics, etc.), and thermodynamics (heat transfer, combustion, etc.). (Fig. 1)

What is *agriculture?* According to Webster's standard dictionary (8)* agriculture is "the science and art of production of plants and animals useful to man, including to a variable extent the preparation of these products for man's use and their disposal by marketing or otherwise, including farming, horticulture, dairying, sugar making, etc." It should be noted that farming is considered just one phase of agriculture in this definition.

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Roanoke, Va., June, 1956, on a program arranged by the Education and Research Division.

The authors — CARL W. HALL and JORDAN H. LEVIN — are, respectively, professor of agricultural engineering, Michigan State University, and agricultural engineer (AERB, ARS), U.S. Department of Agriculture.

*Numbers in parentheses refer to the appended references.

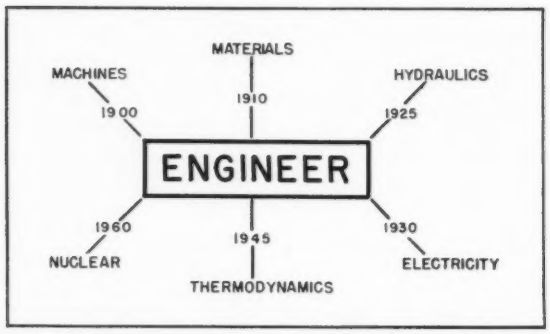


Fig. 1 The chart represents the agricultural engineer and the dates when various branches of engineering were put to extensive use in the agricultural engineering field

What is *farming?* According to Webster it is "the act or business of cultivating land".

What is *processing?* According to McColly and Martin (4) it is "any procedure or treatment that prepares farm products for utilization or preservation". According to Webster, it is defined "to subject to a process of manufacture, development, preparation for the market, etc., to convert to a marketable form, as livestock by slaughtering, grain by milling, cotton by spinning, milk by pasteurizing, fruits and vegetables by sorting and packing, often distinguished from raw materials".

According to the American Society for Horticultural Sciences, "processing occurs when you change the state of the raw material so that it is not used in the fresh state".

The Institute of Food Technology defines processing as "any step taken for the purpose of preservation". Example: if apples are graded for canning, the grading operation is processing; but if apples are graded for the fresh market, it is not processing. Canning, dehydration and freezing are the three methods of preservation included in their definition.

Many agricultural economists state that processing occurs only if there is a definite change of form and/or state. According to them processing and preservation are used interchangeably.

In the theoretical definitions of McColly, Martin and Webster, processing includes preparation of the product for market, preservation or use. However, in practice of the American Society for Horticultural Science, Institute of Food Technologists and the agricultural economists, the term processing as actually used includes preservation only. The statistics concerning processing which are used by the

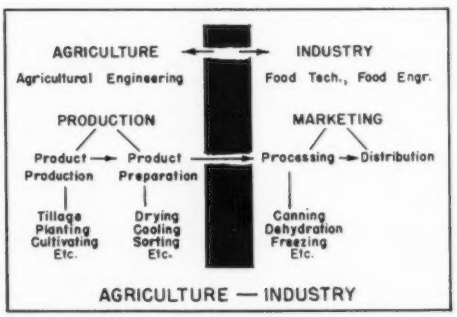


Fig. 2 Examples of product preparation in agriculture and processing in industry

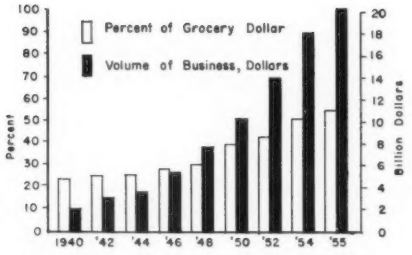


Fig. 3 Volume of business by super markets

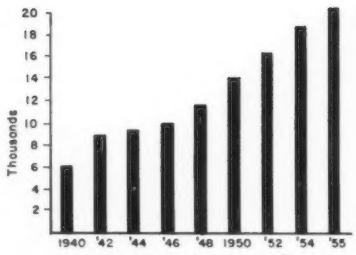


Fig. 4 Number of super markets

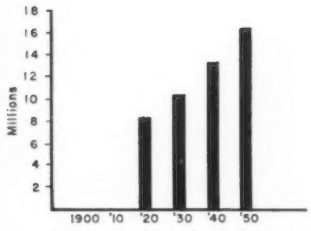


Fig. 5 Women in labor force, full time

U.S. Department of Agriculture, the Department of Commerce Census Data, and most universities, include preservation only.

Agricultural engineers should accept the definition as used in practice by other agricultural professions and not a theoretical one. The authors believe that a new term is needed to adequately describe the field of interest previously referred to as agricultural processing by the agricultural engineering profession. This term is *Product Preparation.*

Any operation on an agricultural product following harvest for any reason is product preparation. This would include storage, conditioning, grading, handling, cleaning, sorting, curing, grinding, etc.

From these definitions it can be concluded that the goals of the agricultural engineer are to solve problems of agricultural product production and agricultural product preparation and associated problems. (Fig.2) The agricultural engineer is therefore more than just a farm engineer — one who would only be interested in problems directed toward the land. On the other hand, the agricultural engineer is not a food engineer. The agricultural engineer is interested primarily in grain, but not bread, he is interested in milk and not cheese, he is interested in cotton and other fibers, but not cloth.

Post-War Changes Affect Production and Preparation

Since agricultural engineers are interested in the two main components of agriculture, namely, production and preparation, a closer look should be taken at the post-war changes which affected these two components.

The rise in super markets has resulted in a high demand for prepacked foods (Figs. 3 and 4). Seven major chains did 35 percent of the grocery business in 1955. This means that their buying is concentrated in the hands of relatively few people who are instructed to obtain a guaranteed supply of packaged foods of uniform grade and quality over a long period.

The number of working married women who want prepared foods has increased rapidly. Today more than 13 million married women are employed in full-time jobs. Other millions are engaged in community service or part-time work (Fig.5).

Today in urban centers one meal in four is eaten out and on the national average one meal in five is eaten in restaurants (7) (Fig. 6). Restaurants demand prepackaged and prepared foods of uniform grade and high quality throughout the year.

The population has increased to 165 million people with 88 percent living in urban centers. Since food is produced in specialized areas it must be shipped long distances and stored for distribution in the highly concentrated areas of population (Fig.7).

Grading laws and food drug laws have been passed to protect the consumer which means that considerable product preparation is now necessary to meet these regulations.

Advances in production equipment make it possible to profitably produce increasingly large amounts of food and fiber with less labor. However, these new machines often create more tasks for product preparation. For example, use of the cotton picker has required more cleaning in ginning. The use of grain harvesters results in a product

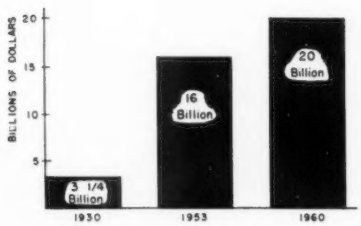


Fig. 6 *(Above)* Restaurant sales

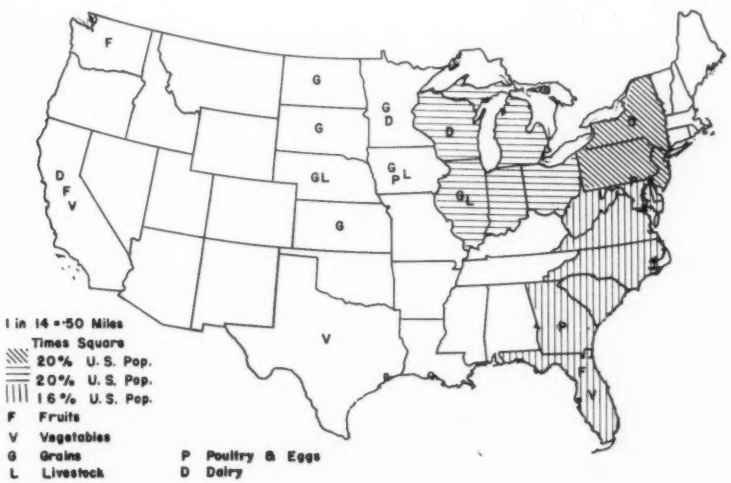


Fig. 7 *(Right)* Producing and consuming areas of agricultural products

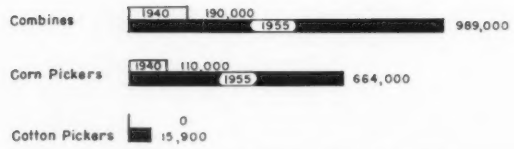


Fig. 8 Increases in production equipment (2)

with high moisture which means that artificial drying is now common. (Fig.8)

Because of these post-war changes product preparation has become very important. Today agricultural commodities must be graded, sized, stored, conditioned, prepackaged, etc., if they are to be marketed.

The Importance of Product Preparation

From the previous discussion it can be seen that product preparation is an important second phase of the production of agricultural commodities. Considerable time and money are spent in this phase and it has considerable influence on the net return of the farm. Apples sold from the orchard at harvest may bring $1.80 to $1.90 per bushel, whereas if they are graded, stored, and transported their value will often be increased to $3.00 per bushel. The loss of cereal grains in handling and storage is often 10 percent of the total production. The annual loss of hay is about 28 percent of the annual production and of vegetable crops approximately 35 percent (5). The percent of vegetables frozen, canned, and dehydrated from 1934 to 1936 was 26 percent as compared to 34 percent for the 1949-1951 period, and for fruits 38 percent and 53 percent, respectively (1). Canners and freezers usually insist that growers produce a specific variety, and size, and deliver the product in good condition. All of these products which are processed (preserved) must be prepared in ways which involve product preparation operations. Cotton is the major agricultural crop in 12 states of the United States, and is of little value as harvested. It must be dried, cleaned, and ginned; that is, product preparation must take place to put it in a usable form. Other examples of product preparation are given in Fig. 9. Thus, product preparation of agricultural products is important, just as the growing of the agricultural commodity is important.

Recognition by ASAE Urged

If our society, the American Society of Agricultural Engineers, is to keep abreast with the developments in agriculture we should recognize that product preparation is rapidly becoming an important part of our work, and that such sciences as thermodynamics and nuclear engineering will play an increasingly important part in this work. The authors strongly urge that ASAE should officially recognize the field of product preparation as part of its organizational activities. By recognizing this field the Society will be indicating a continued aggressive recognition of

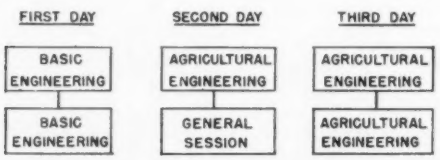


Fig. 10 Suggested meetings arrangement

	Handling	Quality Control	Cleaning	Sorting	Grading	Drying	Curing	Refrigeration	Packaging	Storage	Separation
Milk	X	X	X					X			X
Poultry	X	X	X					X	X		
Eggs	X	X	X	X	X	X		X	X		
Grain	X	X	X			X				X	X
Cotton	X	X	X	X		X			X	X	X
Tobacco	X	X		X	X		X		X	X	X
Fruit	X	X	X	X	X			X	X	X	X
Vegetables	X	X	X	X	X	X	X	X	X	X	X
Forage	X	X				X					

Fig. 9 Examples of product preparation

adjustments needed to keep abreast of a rapidly changing agricultural technology. Product preparation activities should be confined to work on farms and on local enterprises in which farmers have an active interest.

More progress will be made by aligning agricultural engineering activities with agricultural rather than with industrial phases of product preparation (Fig.2). The food, textile, and other such industries have highly specialized requirements covered by several branches of engineering, which in some cases will include agricultural engineers. This does not mean, however, that agricultural engineers or some departments of agricultural engineering will not be interested in the field of preservation.

The U.S. Department of Agriculture has recognized the product preparation activities for a number of years through its mechanical preparation and conditioning section in the Agricultural Engineering Research Branch.

There is more than one way in which ASAE can do this. However, in any procedure which is adopted it is well to keep in mind two important objectives of our Society:

(a) To increase the professional and technical competence of its members, and

(b) To exchange ideas and to keep abreast with the developments in the field.

The writers have discussed these objectives with ASAE members in the various divisions. Several suggestions have been received regarding the improvement of the service of the Society to its members and to agriculture which incorporate the recognition of product preparation.

One suggestion was to devote the first day of the national meeting to basic engineering (Fig.10). Such subjects as electronics, atomic plants for production of electricity, stress analysis and turbines could be discussed. Of the two remaining days, one-half could be devoted to a general session and one and one-half days devoted to new

(Continued on page 619)

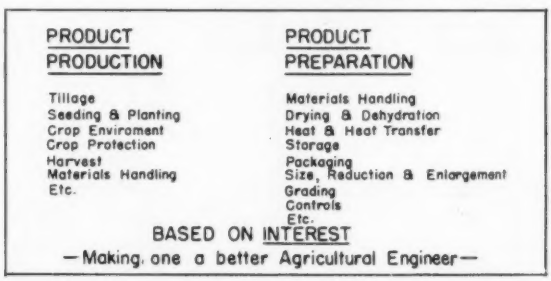


Fig. 11 Subject matter interest for second and third day (1½ day) during national meetings of the Society

Recent Agricultural Chain Developments

J. H. Thuerman and E. A. Paul
Member ASAE Assoc. Member ASAE

In presenting the story of the latest developments in agricultural chain, the authors reveal how applications, costs, and other factors have influenced the development and introduction of the various types of chains commonly being used in the farm equipment industry today

SHORTLY before the turn of this century, the chain industry was just starting to develop in America. This industry was founded primarily to improve upon the power transmission and conveying methods used in the earliest agricultural implement design.

The first product of the new chain industry was a cast malleable iron detachable chain — the forerunner of a whole family of chains to operate over cast detachable chain sprockets.

As implements became more powerful, pintle chain was developed having higher strength and increased wear resistance. For similar reasons, combination chain was made, using cast block links and introducing steel sidebars. These chains both utilized a steel pin and an enclosed barrel to produce a better bearing surface at the chain joint. Finally the steel replacement chain was developed. This chain was made of steel sidebars, pins, bushings, and rollers, and it was furnished in either offset or straight sidebar construction. Illustrations of these chains are shown in Fig. 1.

All of the foregoing chains are still being widely used on agricultural machines where application conditions merit their use. However, in many cases their use increased the cost of the drive or the conveyor. The answer to this cost problem was the development of steel detachable chain. This chain had the advantages of low cost and high tensile strength. It is commonly used today.

Shortly after the cast detachable chain family began to grow, another chain family was introduced primarily for higher speed ranges, which is now the familiar roller chain. From this basic chain, more economical roller chains were developed for use at slower speeds and where larger sprockets could be used. This was accomplished merely by using the same round parts of the chain joint and doubling the pitch of the side plates. It resulted in the presently popular drive series and conveyor series double pitch roller chains. Examples are shown in Fig. 2.

By 1950 the most popular chains used on implements were steel detachable chain, roller chain and double pitch roller chains. However, a wide gap existed, both in performance and in price, between steel detachable chain and double pitch roller chain. In some applications, steel detachable chain was being used at higher loads and speeds, and fatigue breakage was occurring before the chains were worn out. The only recourse for the designer was to adopt double pitch roller chain, but the differential in price was sizable.

With acute farm machine cost problems, the need was apparent for intermediate priced chains, which would run over the same sprockets as steel detachable chain, but have higher fatigue strength. Likewise, intermediate priced chains were needed, which would run over the same sprockets as double pitch roller chain, and give equal or better performance.

In recent years, several new developments have appeared resulting in an addition to the cast detachable chain family designed to run over the same sprockets. These developments may be summarized as follows:

- A hollow rivet chain was made comprised of steel sidebars, bushings, and curled rivets. However, the price is in the double pitch roller chain range.
- A low-cost steel replacement chain was made, with a price range approaching double pitch roller chain.

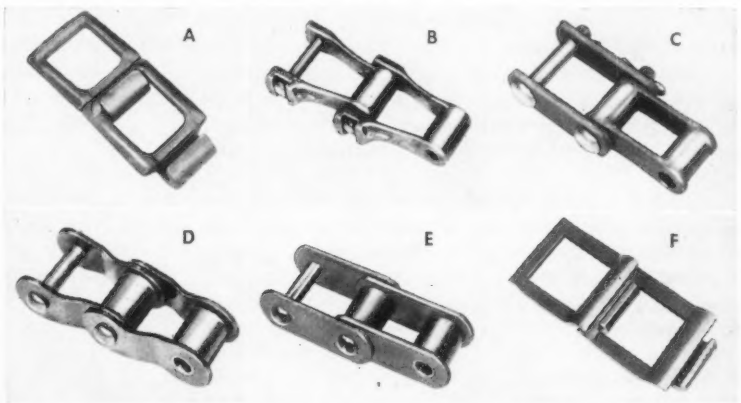


Fig. 1 A group of chains designed to operate over cast detachable chain sprockets. *(A)* cast detachable *(B)* pintle *(C)* combination *(D)* steel replacement, offset sidebar type *(E)* steel replacement, straight sidebar type *(F)* steel detachable

Fig. 2 Roller chains were introduced primarily for higher speed ranges *(left)* roller chain *(center)* double-pitch roller, drive series *(right)* double-pitch roller, conveyor series

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1955, on a program arranged by the Power and Machinery Division.

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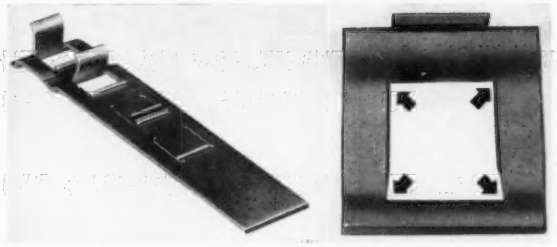

Fig. 3 *(Left)* Steel detachable chain is made from strip steel on continuous dies with no scrap loss • *(Right)* Sharp notches caused from knifing form points for fatigue failure

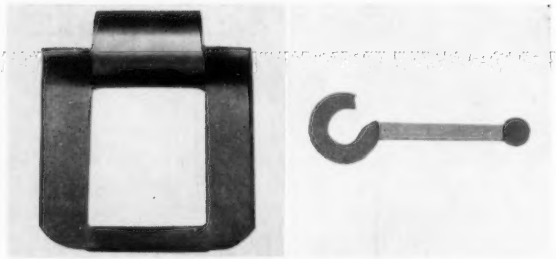

Fig. 4 High-fatigue steel detachable chain link. At right is a cross-sectional view

- A fabricated steel pintle chain was produced, having the cast link of malleable pintle chain replaced by a formed steel link. Again, the price range approaches double pitch roller chain.
- Finally, a new type of steel detachable chain was made having considerably higher tensile and fatigue strength than regular steel detachable chain, and coming closest to it in price. Because of this, the new high-fatigue-strength steel detachable chain offers great promise. This new chain is designated as "HF" steel detachable chain (the designation "HF" denotes high fatigue strength).

The basic design of regular steel detachable chain actually limits its fatigue strength. The chain is made from strip steel on continuous dies in one punch press operation with no scrap loss (Fig. 3). This is accomplished by first knifing into the steel to locate shear lines, and progressively forming the barrel and end bar of each link. The chain barrel and end bar are rolled up from the center of the link, following the shear lines. After the link is formed, sharp notches remain where the knifing ends, in the four corners at the barrel and end bar. These are the points of origin for fatigue failures.

The failures sometimes occur slowly enough to develop the typical fan pattern on the fracture. More often, however, the failure progresses too rapidly for a fan pattern to show up, and the fracture gives the appearance of a brittle type break.

The most urgently needed size of the new HF chain was thought to be the counterpart of regular No. 62A chain, and so No. HF62A chain was developed. It was necessary to overcome severe tooling problems to produce this chain continuously in one punch press operation. The first successful production of No. HF62A chain was made in November, 1954.

The design of this chain is quite different. The center portion of each link is blanked out with radii in all four corners. This makes it necessary to roll the barrel up from in front of the link and, therefore, use more steel to make each link. The end bar is coined to produce a good bearing surface, as shown in the sectional view of a link (Fig.4).

Laboratory testing of No. HF62A chain showed that an improvement in tensile strength of 33 percent over regular No. 62A chain was achieved. More important, however, the fatigue curves indicate the major benefit of the new chain. The vertical axis in Fig. 5 shows percentage improvement in fatigue strength. The line representing 1,000,000 loading cycles indicates that the fatigue strength of No. HF62A chain is about 150 percent greater than that of regular No. 62A chain. Reading the curves in Fig. 5 from left to right indicates that the load which would cause premature failure of regular No. 62A chain at 100,000 loading cycles, did not cause No. HF62A chain to fail at 10 million loading cycles.

Comparative wear-testing also was performed under laboratory conditions. Because of its truer bearing surfaces, it was found that No. HF62A chain had less break-in wear than regular No. 62A. However, since the bearing areas are about equal, the wear rates of both chains are about the same after the break-in period. Wear patterns on the sprocket teeth also were analyzed, with both chains operating with the closed side of the barrel contacting the teeth — as is the recommended practice. Observations were made on the driver and driven sprockets with the chains traveling both barrel and end bar forward. The amount of sprocket wear produced by No. HF62A chain was found to be the same as that produced by regular No. 62A.

Attachment links currently being used are the projection welded type and offer great flexibility in design and tooling (Fig. 6). A leading and trailing link is required, since the attachment bridges the barrel of the link and disassembly cannot be made at that point. Thus, attachments must be spaced every third link or greater.

Laboratory test results on projection welded attachments indicate the value of their design. Fatigue tests were conducted on chains with attachments spaced every third link. In every test, the link which finally failed was one of the plain links. Moreover, destructive hammer tests on the

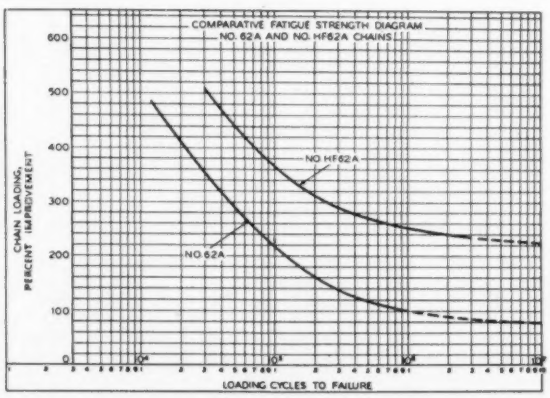

Fig. 5 Percentage improvement in fatigue strength between No. 62A and No. HF62A chain plotted on semi-log paper

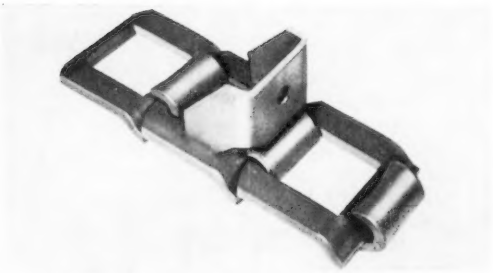

Fig. 6 Attachment link for No. HF62A chain

front face of the attachment showed equivalent results, when performed both before and after fatigue testing. Tensile type testing against the front face of the attachment showed the weld strength and the load required to cause permanent deformation of the attachment, to be well above the recommended working load of the plain chain.

Possibilities for further development work might well be the production of: (*a*) other sizes of HF steel detachable chain to meet future demands, and (*b*) one-piece type attachment links, which are made integral with the plain links. Such a development program will require careful planning to insure that such chains will offer economic advantages. Preliminary analysis indicates that changing from a small size to a heavier size of regular steel detachable chain, could solve a breakage problem, and yet be more economical than changing to a high-fatigue-strength version of the small chain. Therefore, the high-fatigue type chain appears to have the most advantage in the large chain sizes. Tooling problems will have to be overcome, and further fatigue testing performed before other sizes and attachments are produced.

It should be noted that the high-fatigue chains are not expected to obsolete regular detachable chains. For many applications the regular chains are adequate and relative costs must be considered. However, for the more critical applications the high-fatigue-strength chain appears to be an economical choice.

Fig. 7 Tight joints often develop in standard double-pitch roller chain

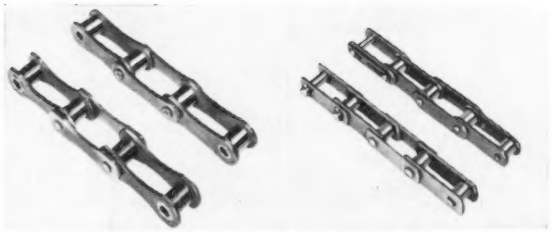

Fig. 8 Illustrations show *(left)* drive series double-pitch roller chain on top and sintered bushing rollerless chain on bottom; *(right)* conveyor series double-pitch roller chain on top and large-pin diameter rollerless chain on bottom

In recent years, several new developments have also appeared in roller chains. Some applications have shown the need for increasing the wear resistance of double-pitch roller chain. Other applications indicate a need for increasing the resistance to tight joint formation, by increasing the ability of the chain to accept minor, unavoidable sprocket misalignment.

An agricultural series double-pitch roller chain was developed to reduce tight joint formation. This chain is quite similar to standard double-pitch roller chain. It is made on the same dies, so its physical appearance is almost identical.

The difference between the chains is in the material used and in the control of the parts. The agricultural double-pitch roller chain uses hot-rolled steel in place of cold-rolled for the side plates, and in some cases uses plain carbon steel instead of alloy steel for some of the parts. Also, size tolerances are allowed to be slightly greater. The development of this chain in conjunction with the high-fatigue steel detachable chain has resulted in filling the cost void between steel detachable chain and double-pitch roller chain. The performance of the agricultural chain approaches, but does not equal that of the standard double-pitch roller chain. This means that this chain can be used for all except the toughest jobs that are presently handled satisfactorily by standard double-pitch roller chain. Because of this and the fact that it is completely identical dimensionally to the standard chain, it answers some of the designer's problems in cost reduction.

This agricultural series of double-pitch roller chain does not, however, provide increased wear resistance and ability to accept sprocket misalignment. Because it was felt that many agricultural implement applications actually did not need the presence of a roller, two types of rollerless replacement chains have been developed to answer these performance problems as well as the cost problem. These chains are at the same cost level as the agricultural double-pitch chain, and both have a bushing diameter approximately the same size as the roller diameter in double-pitch roller chain for operation on the same sprockets.

One of these new rollerless chains is made with a sintered metal bushing with the wall thickness of the bushing such that the standard pin diameter can be used. This extremely thick bushing wall is necessary to obtain the required strength in a sintered metal part. One of the principal objectives of this design was to provide an oil-soaked bushing which would supply its own lubricant in service. In addition, this bushing extends slightly beyond the side plates and provides positive clearance between the

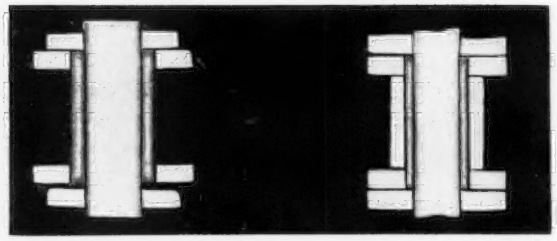

Fig. 9 Design comparison between cross-sectional views *(left)* large-pin diameter rollerless chain and *(right)* standard double-pitch chain

roller link and the pin link. This clearance tends to prevent tight joints.

The other type of rollerless chain is made of standard types of steel throughout, rather than from any sintered metal parts. It has an increased pin diameter over the standard double-pitch chain, an increased bushing wall thickness, and increased clearances. Fig. 9 shows polished and etched cross sections at the chain joint and indicates the design difference between this new chain and standard double-pitch chain.

The greater cross section of the parts in the new rollerless chain permits increasing the depth of the case-hardened surfaces. This results in a surface which is more wear resistant. Actual field testing of a conveyor chain, supported on the bushings, produced very little wear on the surface of the bushings. It is true that the rollerless chain does produce somewhat greater sprocket wear, but this has not proved to be a critical factor in any of the field testing done to date.

The new chain also resists tight joint formation. (Tight joints prevent a chain from flexing properly and are usually caused by the roller link plates working off the bushing and pressing against the pin link plates with enough force to prevent proper flexing. This movement is resisted by the force which is caused by press fitting the bushing into the plate hole. Since this bushing is a very thin-walled cylinder, it tends to collapse under the pressure of the press fit. This slight collapsing reduces the holding power of the planned interference.)

The bushing in this new large-pin diameter chain, since it is much huskier than the bushing in double-pitch chains, has much less of a tendency to collapse under the planned interference. The results of this are shown by comparing the force needed to push the bushings out of the plates on the standard type chain and on the new large-pin diameter

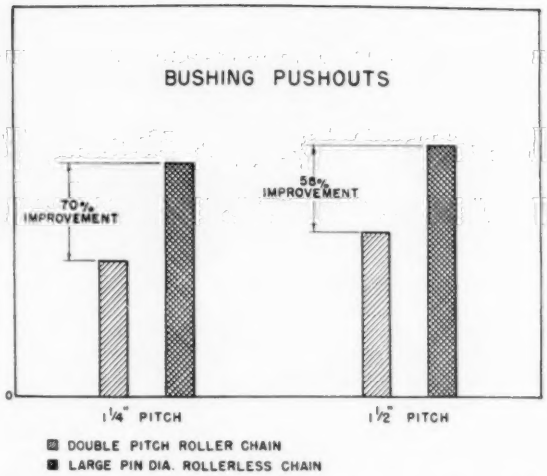

Fig. 10 A comparison of the force required to push bushings out of plates. Bushing pushout is a common cause of tight joint formation

chain (Fig. 10). This, of course, indicates also the resistance to tight joint formation.

Another common cause for the development of tight joints is the build-up of foreign material in the chain joint. The increased clearance between the moving parts of this new chain allows much of this foreign material to work its way out of the chain before the damage can occur.

The increased clearance between moving parts also increases the ability of the new chain to accept minor misalignment. Comparing the amount of side-bow possible between double-pitch roller chain and this new chain (Fig. 11), indicates the ability of the new chain to accept more misalignment. This has a definite effect on the resistance to tight joint formation, as misaligned sprockets tend to force the plate off the bushing. Since more misalignment can be accepted with this new chain, there is less likelihood of encountering this type of force.

A considerable cost saving can be realized if cast-tooth sprockets can be used instead of cut-tooth sprockets. Although many agricultural implements now use cast-tooth sprockets, double-pitch roller chain was not designed for operation over these relatively rough sprockets. The new rollerless chain is designed with the necessary clearances for operating on cast-tooth sprockets and in many cases offers cost saving.

While the new chain will run over the same sprockets

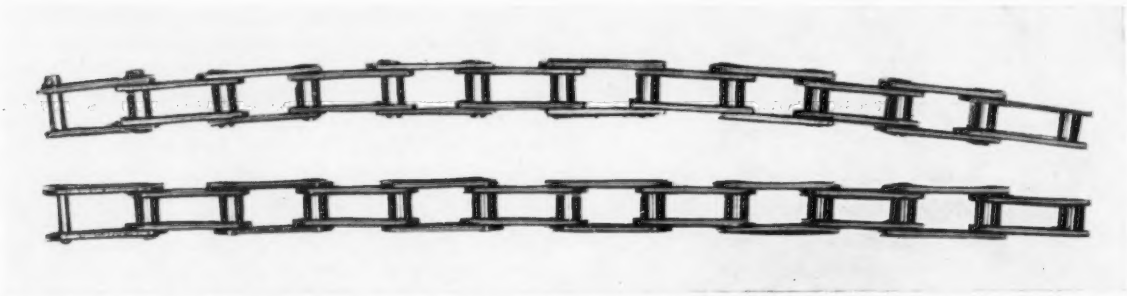

Fig. 11 The large-pin diameter rollerless chain is shown on top with increased clearance between moving parts. This clearance increases the ability of the chain to accept minor misalignment

as standard double-pitch roller chain, it will not couple with it. Thus, an entire chain can be replaced, but it is not possible to substitute a few links of one type of chain in the other. However, in many cases the improvement in the new chain's performance outweighs this disadvantage.

To successfully fit into existing applications, the attachments for this new type of chain have been designed as closely as possible to standard double-pitch roller chain attachments. Flights or other members which might be riveted to the chain attachments usually would not have to be changed for use with this new rollerless chain.

Until recently, correctly designed agricultural chain has been available for most applications and cost ranges. The developments described in this article provide new chains to assist the agricultural implement industry in further meeting application and cost requirements.

Design of a Flood-Retarding Structure

(Continued from page 609)

tered 7) or hood is placed over the riser to prevent whirlpool action. It has been found from model studies that flow of water into the top of the riser may be reduced as much as 70 percent if vortices are allowed to form.

What can a dam of this type do for Berkeley Springs or any watershed where it is suited? Flood prevention-wise, the flow and sediment deposition downstream of the dam, especially in and around the town, will be reduced for all storm flows. Immediately downstream from the dam the 20-year storm flow will be reduced from 326 cfs to 19 cfs. For the 100-year storm it will be reduced from 628 cfs to a peak outflow of about 60 cfs. This will mean a reduction in flood damage to homes, stores, industries and other existing flood plain property. This amounts to an average of $3,486 annually, based on 1954 prices.

The opportunity for such flood control work is greatly expanded by the Watershed Protection and Flood Prevention Act (Public Law 566) passed by congress in 1954 and amended in 1956.*

This act defines small watersheds as those under 250,000 acres in size. Federal responsibility for flood prevention under this act in these upstream watersheds is assigned to the U.S. Department of Agriculture. The Soil Conservation Service of the U.S. Department of Agriculture supplies technical personnel to assist local groups in developing necessary watershed plans, and shares in the cost of applying the program to the land.

Under the law, flood prevention on small watersheds is a cooperative effort from start to finish. The local people affected by flooding must initiate the action. They can do this by requesting aid through their own soil conservation district, by forming a watershed association, or by working through a combination of these organizations. The local organization then applies for watershed assistance to the committee set up by the governor. If approved by that committee the application is forwarded to the state conservationist of the Soil Conservation Service. The local groups are also assisted by county agents, Agricultural Stabilization and Conservation people, the Farmers Home Administration, Soil Conservation Service technicians, state conservation and highway departments and many other public and private agencies.

Flood reducing measures that reach final design stage are those that will return benefits greater than their cost. About one-half the cost of land treatment and structural work is paid for by the people in the watershed.

*Effective July 1, 1956, legal and engineering design requirements have changed, based on congressional committee hearings and on Public Law 1018. These changes are not included in this article.

Draft Measurement for Tillage Tools

(Continued from page 608)

lem seems satisfactory, although it is felt that further investigation is desirable.

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Weather Modification

AN ARTICLE in *The Wall Street Journal* (Dallas edition) July 30, states that weather modification work has grown steadily and demand for rain making is increasing. The article reports that rain makers are plying their cloud-seeding trade in many countries throughout the world, and explains that the weather engineer's ability to increase rainfall and to forecast for industry and agriculture is becoming increasingly important.

It points out that the public still thinks of rain makers as adventurers who dump sacks of dry ice from planes, but today most rain makers use a ground generator. This generator is a small furnace which burns coke that has been impregnated with concentrations of silver iodide. When the coke is burning, tiny crystals ascend toward the clouds and, if all goes well, will form nuclei of snowflakes which turn to raindrops in warm weather.

According to the article the rain makers do not claim to change natural laws, but find that the silver iodide generators can trigger more rain from rain clouds than would normally fall and can provide a more uniform distribution of rain. To the rain maker this fertilizing of the clouds is the same idea as fertilizing the ground.

Instrument Records Heart Rate for Energy Studies

W. E. Splinter and C. W. Suggs
Member ASAE Assoc. Member ASAE

TIME and motion studies have been devised and utilized to quantify the relative difficulties of various methods of performing a given task. Such studies indicate that one method will allow an individual to perform a certain number of operations per minute, while another method will allow the individual to perform a greater number of operations in the same time. The actual energy required to do the task by the first method as compared with the energy required for the second method is not known and if it is of concern, it is generally implied that if the output of the second method is greater than that of the first method, then the second method is therefore easier or less fatiguing. This may not always be the case. Nor is it possible to conclude from a time and motion study that one operation (scooping grain for example) is more or less tiring than some entirely dissimilar operation such as picking fruit from a tree or loading bales of hay.

It would, therefore, be of considerable value to have some standard of comparison by which the relative difficulty of two tasks might be determined independent of the technique or even the nature of the tasks involved.

A review of literature (1), (2)* discloses that there are methods by which the energy output of an individual may be measured by the change in his physiological processes. It has been shown that the increase in oxygen consumption varies almost linearly with increased work output. Methods for obtaining oxygen consumption involve the strapping of a mask to the subject's face from which respiration samples are taken. The device is somewhat cumbersome and uncomfortable for the operator to wear.

This paper was prepared expressly for AGRICULTURAL ENGINEERING. Approved by the director of the North Carolina Agricultural Experiment Station as Journal Paper No. 732.

The authors — W. E. SPLINTER and C. W. SUGGS — are, respectively, research associate professor and research instructor, North Carolina State College, Raleigh.

*Numbers in parentheses refer to the appended references.

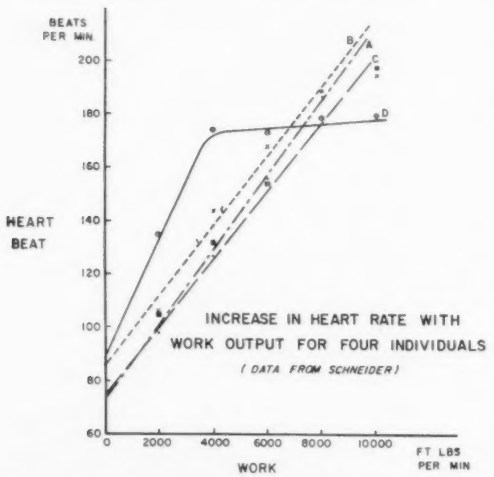

Fig. 1 The pulse rate is plotted against work loads for four individuals. Data were obtained by Schneider (1)

Recognizing that an increase in heart rate over its resting rate is linear with increasing effort, an electronic device was developed to record heart rate before, during and after a task

It was also disclosed that the increase in heart rate over its resting rate is linear with increasing effort within the limit of extreme energy output, recognizing that the resting rate varies from day to day and even with time of day. Fig. 1 shows the pulse rate as plotted against work loads for four individuals as obtained from data by Schneider (1).

This increase in heart rate was used by Suggs (3) for the determination of the amounts of energy required for priming tobacco by various methods. A common stethoscope was used to determine the heart rate before and immediately after the performance of the task in question. This method had the following disadvantages:

(a) The operation of taking heartbeat rate was somewhat cumbersome and was subject to the possible human error involved in counting beats within a time interval designated by a stopwatch.

(b) No permanent record was made.

(c) Since the readings could be taken only before and after the operation was performed they were subject to the error imposed by decreasing heartbeat rate immediately after the subject ceased working.

(d) No record of heartbeat increase during the work period was obtained.

In order to obtain a continuous record of heartbeat during performance of a task other methods of heartbeat detection were investigated. Since the detection of heart rate can be accomplished through chest microphones, body potential measurement and mechanical displacement of the arteries investigations were carried out to determine which method could be most easily utilized for field studies.

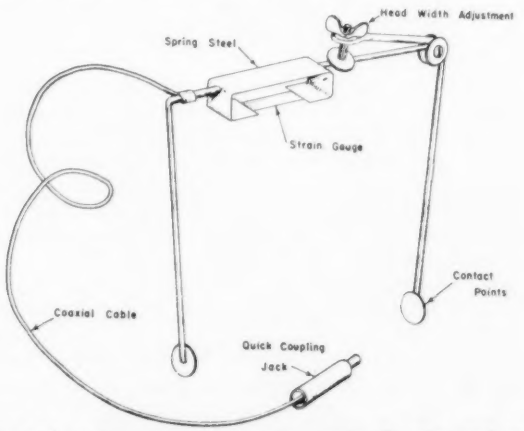

Fig. 2 A strain gage mounted across a strip of spring steel and connected by rods to pads at each temple detects arterial displacement

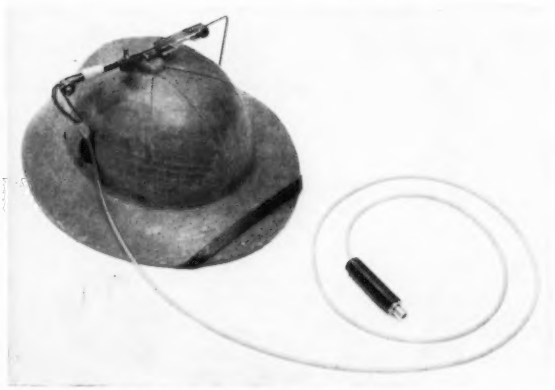

Fig. 3 Heart rate pickup device is mounted in a helmet for easier transfer between individuals

Consideration of the chest microphone method indicated that whereas the heartbeat could be clearly heard for an individual at rest, when it was applied to an individual in motion, clothing and chest noises made counting more difficult. Examination of electrocardiographs, in which heart rate is determined by the increase in body potential, indicated that the heartbeat was not readily discernible without considerable experience.

Efforts were therefore directed toward mechanical pickup of arterial displacement. The area at the temple was chosen as this region is fairly free from muscular activity which might introduce extraneous signals.

With a contact pressure of 2 to 3 ounces the arterial displacement was found to be on the order of 0.002 inch. This displacement was detected by means of a strain gage mounted across a strip of spring steel which served as a multiplier linkage. This linkage was connected by rods to pads placed at each temple (Fig. 2). The deflection of the gage was of the order of 10 to 20 microinches.

This strain resulted in a change of gage resistance which was detected by means of a bridge circuit, the unbalance of the bridge being amplified through a d. c. amplifier and recorded on an oscillograph. Two pickup units were constructed and mounted in helmets as shown in Fig. 3. The helmets could then be transferred from one subject to another with little difficulty. These units were used in energy studies of the tobacco transplanting operation during the 1955 season. A sample of the record obtained by this method is shown in Fig. 4.

In field operation the electronic equipment was mounted on a platform on a tractor for mobility. A portable motor-generator set provided the necessary electrical power.

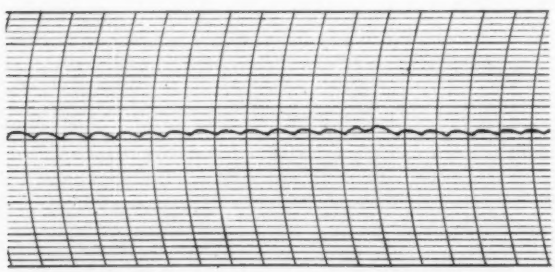

Fig. 4 Pulse rate record. Chart speed was one division per second

The amplifiers were connected by means of coaxial cables to the individuals under study. The event marker on the oscillograph was energized from the tractor battery and enabled timing of the runs.

The results of this study indicate that a satisfactory record of heart rate can be obtained before, during and after a task for energy studies.

The precision of energy measurement is dependent on the experimental design. In subsequent experiments it was found that a change in heart rate of four beats per minute could be attributed to a change in energy output at the 99 percent confidence level. This information along with the output rate for the task allows for a determination of the most efficient method of performing the operation from the standpoint of unit work output per unit of energy output.

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Agricultural Product Preparation

(Continued from page 612)

and practical applications of agricultural engineering. These topics could be grouped according to product production and product preparation (Fig.11) or according to problem fields.

The exact method of carrying out the outlined objectives needs to be worked out by the Society. However, it is believed that this can be done without greatly changing the present Society structure.

The Summary

In summary it has been pointed out that product preparation is of major importance to agriculture and to agricultural engineers. Processing as accepted by most agricultural workers refers to preservation only, and is therefore too limited and not descriptive of the work of most agricultural engineers. The profession of agricultural engineering should be aware of and recognize the importance of product preparation. The method of meeting the objectives should be decided by ASAE in the near future. The Society should keep up with the changing times and continue to improve its service to its members and to agriculture.

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NEWS SECTION

Farm Electrification Conference

THE American Institute of Electrical Engineers Farm Electrification Conference will be held in Memphis, Tenn., at the Hotel Peabody, October 29, 30, and 31.

J. H. Oliver, member of ASAE, is program chairman and has extended a cordial invitation to all ASAE members. Details of the program may be obtained from J. H. Oliver, Light Mfg. and Service Industries, General Electric Co., 1 River Rd., Schenectady 5, N. Y.

World Plowing Contest

THE 4th Annual World Plowing Contest will be held at Shillingford, Oxford, England, October 10 to 12. Teams from fourteen countries will be competing and ten other countries will be sending either competitors or observers — including Russia, Yugoslavia, East Germany, Rumania and Egypt.

The "Golden Plough" trophy is awarded each year to the winner and is symbolic of world supremacy in the craft of plowing. It is a scale model of an old Norfolk plow —the original of which is in the science museum, South Kensington, London.

As an added feature this year, it has been announced that Canada will present a "Golden Plough" replica for a cairn of peace at Shillingford. The World Ploughing Organization plans to erect a commemorative cairn on the site of each world plowing contest, which is held in a different country each year. The cairn at Shillingford is to be built of Cotswold stone supplied by local farmers. It is also hoped that each participating country will contribute a piece of native stone engraved with the country's name to form a surround, which will be surmounted by the 4-ft plow model.

New British Agricultural Engineering Research Journal

THE British Society for Research in Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England, has announced publication of a new technical journal to be published semi-annually. The new publication has been named officially the "Journal of Agricultural Engineering Research." W. H. Cashmore is editor-in-chief and M. A. W. Taylor is technical editor.

Volume 1, recently published, contains over one hundred pages of technical material which includes ten articles, two reviews, and one translation. The editors report that papers not published elsewhere may be submitted for publication in the new journal. An editorial board consisting of nine members select the papers for publication. Additional information may be obtained by writing direct to The Technical Editor.

Fifth National Dairy Engineering Conference

THE Fifth Annual National Dairy Engineering Conference will be held February 26 and 27, 1957, at the Kellogg Center, Michigan State University, East Lansing. The program is being sponsored by the agricultural engineering department in cooperation with the department of dairy and continuing education. Completed programs will be available January 1, 1957. Copies may be obtained by writing to Carl W. Hall, Agricultural Engineering Dept., Michigan State University.

ASAE Meetings Calendar

October 13—MICHIGAN SECTION, Michigan State University, East Lansing

October 24-26 — PACIFIC NORTHWEST SECTION, Penticton, British Columbia

October 26, 27—OHIO SECTION, Ohio State University, Columbus

November 16, 17 — TENNESSEE SECTION, University of Tennessee, Knoxville

December 9 to 12 — WINTER MEETING, Edgewater Beach Hotel, Chicago

February 4-6 — SOUTHEAST SECTION, Birmingham, Ala.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

Plans New Tobacco Journal

A NEW scientific journal containing technical manuscripts concerning tobacco will be available soon, according to an announcement by Noble Clark, chairman of the publications subcommittee of the Land Grant College Association's Experiment Station Committee on Organization and Policy. He reported that the new publication will be published as a *Tobacco Science* section of the journal, *Tobacco,* and will include reports, and scientific and technical articles on tobacco, in fields of science including chemistry, physics, engineering, botany, physiology, agronomy and soils, pathology, entomology, and economics. It will be published in New York by the Lockwood Trade Journal Co. Inc.

Arrangements leading to the new publication have been under consideration for many months and represent the cooperative efforts of tobacco scientists and administrators from industry, U. S. Department of Agriculture, and various colleges and universities.

Preliminary plans call for running the articles in weekly issues and publication is expected to begin as soon as a sufficient number of manuscripts has been approved by the editorial board.

MEMBERSHIP STATUS

"50 Hundred Members In Our 50th Year"

This slogan was originated by ASAE President Roy Bainer during the 49th Annual Meeting in June

June 1, 1956	4706
July 1, 1956	4727
August 1, 1956	4748
Applications being processed	145

Usually complete processing requires about two months after application has been received by ASAE Headquarters

Grassland Program Open for Volunteer Speakers

HOWARD B. SPRAGUE, chairman of Section O (agriculture) of American Association for the Advancement of Science, has announced that volunteer speakers are being given an opportunity to present papers during the New York meeting to be held in December. The theme of the program is "Grasslands in Our National Life" and will be held at the Hotel Martinique, New York City, N.Y., December 26 to 31.

The program consists of three major parts. Volunteer papers by any qualified person on grassland reports, research and practice will be presented on December 27 and 28. A symposium of invitation speakers will be held on December 29 and 30. The third portion of the program will be companion programs on grasslands by several individual societies.

Members of the American Society of Agricultural Engineers and any of 23 societies affiliated with AAAS are eligible for submittal of volunteer papers. Titles of volunteer papers must be received by Howard B. Sprague, Pennsylvania State University, University Park, Pa., by September 25, and abstracts should be submitted by October 15. It has been requested that papers, in general, should not require more than 15 to 20 minutes for presentation.

Four sessions are planned for December 29 and 30. The first session will be on forage utilization and related animal nutritional problems with D. W. Colvard, North Carolina State College, as leader. The second session, held in the afternoon of December 29, will be on forage production in temperate humid regions with H. P. Murphy, Cornell University, as leader.

The third session, held in the morning of December 30, will be on sciences in support of grassland research, with H. B. Sprague, Pennsylvania State University, as leader. The afternoon session will be on grassland machinery and equipment, structures and irrigation systems with E. G. McKibben, U.S. Department of Agriculture, as leader. Walter C. Hulburt, T. W. Edminster, E. A. Silver, J. D. Blicke, and C. K. Otis, all ASAE members, will present papers during this session.

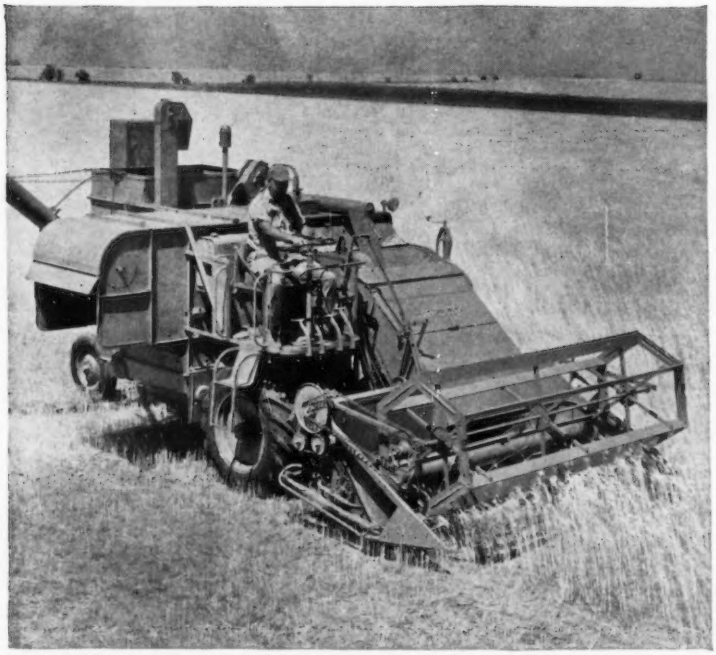
Employment Practices Booklet

THE National Society of Professional Engineers has published a 23-page booklet on employment practices criteria. Printed in check-list format, the criteria cover specific categories of engineering career development. The responsibilities of the employer to his professional employees, and the latter's responsibilities to the employer are also discussed. Topics included are recruitment, indoctrination, professional development of the individual, salaries, engineering titles, personnel practices, and termination policies.

The criteria were developed by the NSPE engineer-in-industry subcommittee of the Employment Practices Committee. Single copies may be obtained for 25 cents each from NSPE headquarters, 2029 K St., N. W., Washington, D.C. Prices for quantity orders are: 20 cents each for 10 to 49 copies; 15 cents each for 50 to 99 copies; and 10 cents each for 100 or more.

How behind-the-scenes services make Link-Belt chain

a credit to your machine



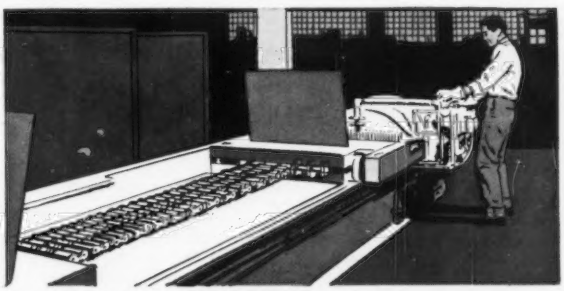
It's Link-Belt double-pitch "AG" roller chain and Steel Link-Belt for the many power transmission and conveying jobs on this Allis-Chalmers Model 100 self-propelled ALL-CROP Harvester. The Link-Belt line includes cast, combination, forged and fabricated chains, roller and silent chain plus matching sprockets and attachments.

Broad facilities and experience are your assurance of quality chain, correctly applied

THE services illustrated below are part of the exhaustive Link-Belt procedures that guide selection of the right chain for your machine. Link-Belt can make an unbiased recommendation because our line of chains, sprockets and attachments is *complete*. Every pertinent requirement is considered —horsepower, loading, fatigue life, speed, chordal action and many others.

Next time you're faced with a drive or conveyor application, we will be glad to work with your engineers in solving all problems. Contact your nearest Link-Belt office for full information.

EXPERT ENGINEERING AND FIELD TESTING. Link-Belt's engineering staff is unequalled in ability and experience. Working with equipment manufacturers in field tests, they can interpret needs based on chain performance under actual working conditions and make correct recommendations.



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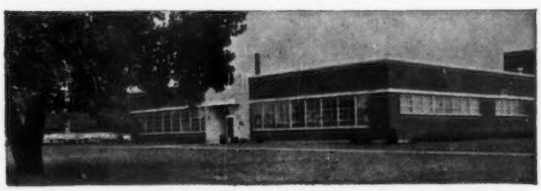

LABORATORY CONTROL. Every chain bearing the Link-Belt trade mark meets rigid uniformity specifications. Our modern laboratory continuously explores new refinements to increase chain life. It is located adjacent to the world's largest plant devoted to manufacturing drive and conveying chain.

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CHAINS AND SPROCKETS

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Martin Ronning, chief consulting engineer of Minneapolis-Moline Co., has been promoted to chief engineer of research. Relieved of the details of engineering administration, he will spend full time on creative problems dealing with company projects for new farm machines and on modifications of current models.

His career with the company has been one of steady progress since he joined them in 1927. He has devised many improvements of machine models and elements, climaxed by his invention in 1950 of the Uni-Farmer system of self-propelled farm machines. This system is based on a single, 3-wheeled drive unit on which many different farm machines are mounted interchangeably.

Mr. Ronning is an active member of ASAE and was awarded the Cyrus Hall McCormick Medal at the Society's 49th Annual Meeting in June. He is active in other professional engineering societies and is closely associated with the work of the National Safety Council, the Farm Equipment Institute, and the Committee for Uniform Motor Vehicle Laws.

•

Julian M. Fore has resigned as head, agricultural engineering department, University of Massachusetts, Amherst, to accept the position of associate professor of agricultural engineering, North Carolina State College. In his new position he will be in charge of an educational program called Engineering Applications, and will teach courses in farm machinery.

He was born in Fort Mitchell, Virginia, and received a B.S. degree in agricultural engineering from Virginia Polytechnic Institute. Following graduation, he was awarded a research fellowship at Purdue University where he received an M.S. degree in 1937. He has held a number of positions which include research assistant with the Indiana Agricultural Experiment Station; head of the education section of the agricultural engineering division of the Tennessee Valley Authority; assistant sales manager of Aerovent Fan and Equipment Co.; and instructor in the training department of the Tractor and Implement Division, Ford Motor Co.

•

Charles W. Wilson, formerly assistant county agent for the South Carolina Extension Service, has accepted a position as assistant professor of agricultural engineering, Louisiana Polytechnic Institute, Ruston.

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George H. Dunkelberg, associate professor of agricultural engineering, South Carolina Agricultural Experiment Station, has accepted an assignment on the staff of the Indian Institute of Technology in Kharagpur, West Bengal, India. He will be on assignment from the University of Illinois under the International Cooperation Administration program and will spend two years in India.

•

Robert White, extension agricultural engineer, Michigan State University, is now on leave, until October 1, to serve as coordinator for a foreign visitors short-course. The group consists of visitors from South America and Jordan. After completion of the first part of the course at Michigan State University, they will tour the states of Nebraska and Mississippi.

•

Paul R. Nixon, formerly associate agricultural engineer, Iowa State College, is now a project leader for the Agricultural Research Service, USDA, and will be located at Lompoc, Calif. Before he joined the staff at Iowa State College he had been employed by the U.S. Soil Conservation Service at Riverside, Calif.

ASAE MEMBERS in the News

M. RONNING

J. M. FORE

Glenn O. Schwab, formerly professor of agricultural engineering at Iowa State College, has accepted a position as professor of agricultural engineering at Ohio State University. His new duties include both teaching and research.

•

Carl F. Albrecht, associate professor of agricultural engineering at Michigan State University, has accepted an assignment for two years as technical consultant in agriculture, Foreign Operations Administration, at the Facultad de Agronomia, Palmira, Colombia, South America. The assignment is under the provisions of the Point IV program and is designed to assist natives in setting up and operating a college agricultural engineering department.

•

W. M. Cade, chief engineer in the advanced engineering department, International Harvester Co. of Chicago, has been transferred as chief engineer of the Memphis, Tenn. plant.

Sherman C. Heth has been promoted from staff engineer to chief engineer in the advanced engineering department to succeed W. M. Cade.

•

Jack D. Traywick is in Peru on a two year assignment as a technical advisor in agricultural engineering and as a member of the Agricultural Research Mission from North Carolina State College.

He and his family are located at Tingo Maria on one of Peru's experiment stations.

New Membership Dues Schedule

The Council of ASAE has approved a new schedule of fees and dues which will become effective January 1, 1957.

Range of ages	Annual dues	Admission fees	Reinstatement fees
26 and under	$10.00	$ 5.00	$2.50
27 to 34 incl.	14.00	7.50	3.75
35 and over	17.00	10.00	5.00

No exceptions to this schedule shall apply to members, foreign or otherwise, except those serving in the Armed Forces of the United States who request military service credit (one-half the rate for established annual dues). Members excused from dues under paragraph 9, Article B5 of the By-Laws are not affected by this new schedule.

Under the new schedule most members will pay an increase of $2.00 per year, and no member will pay more than a $5.00 increase per year.

Official notification has been mailed to all members by special letter from the office of ASAE Secretary.

Robert H. Brown, associate professor of agricultural engineering at the University of Georgia and recipient of a Danforth Foundation Teacher Study Award, will attend Cornell University this fall for work toward a PhD degree in agricultural engineering.

He is the first agricultural engineer to receive this award and was chosen as one of 62 from over 600 applicants in the United States this year. Not only was he the only agricultural engineer, but he was the only engineer selected. The award is based on excellence in teaching and outstanding Christian leadership. It includes full college expenses for 12 months and a salary.

Mr. Brown is the author of a recent book, entitled "Farm Electrification."

•

J. H. Thuerman has been promoted to supervisor of application engineering in the chain and transmission division of the Chain Belt Co., Milwaukee. Formerly he was assistant to chief engineer.

•

Robert B. Hickok, for the past 23 years in soil and water work with the U.S. Department of Agriculture, has resigned his position as supervisor of hydrology studies in the Southwest for the Agricultural Research Service, to accept a position with Holmes and Narver, Inc., engineers and constructors, Los Angeles, Calif.

•

Dwight D. Smith has been appointed work project leader in the Eastern Soil and Water Management Section at Beltsville, Md., where he will be responsible for soil and water management practices for conservation farming; design of terracing, stripcropping, and water systems for sloping lands; and the runoff and erosion project. Formerly he was project supervisor with ARS, U.S. Department of Agriculture in Missouri.

•

T. W. Edminster, agricultural engineer who is serving as drainage work project leader in the Eastern Soil and Water Management Section at Beltsville, Md., has, in addition to his regular duties, new responsibilities as assistant to the section head in program coordination and administration.

•

L. E. Myers, Jr. has been appointed technical staff specialist on the integration of soil and water management practices for conservation practices for conservation farming with headquarters at Beltsville, Md. Formerly he was irrigation engineer with the Western Soil and Water Management Section, ARS, U.S. Department of Agriculture in Reno, Nevada.

•

D. M. Burns has accepted a new position as mechanical superintendent with the Honokaa Sugar Co. of Haina, Hawaii. Formerly he was employed by the Kaiwiki Sugar Co. as automotive superintendent.

•

Richard E. Hanson is now employed as irrigation engineer with the Rainy Sprinkler Sales of Peoria, Ill. Previously he was irrigation research engineer in the agricultural engineering department at Kansas State College, Manhattan.

•

Philip A. Smith, formerly an instructor at the New York State Agricultural and Technical Institute, has accepted a position as research and development engineer for the B. F. Goodrich Co., Aviation Products Div., Troy, Ohio.

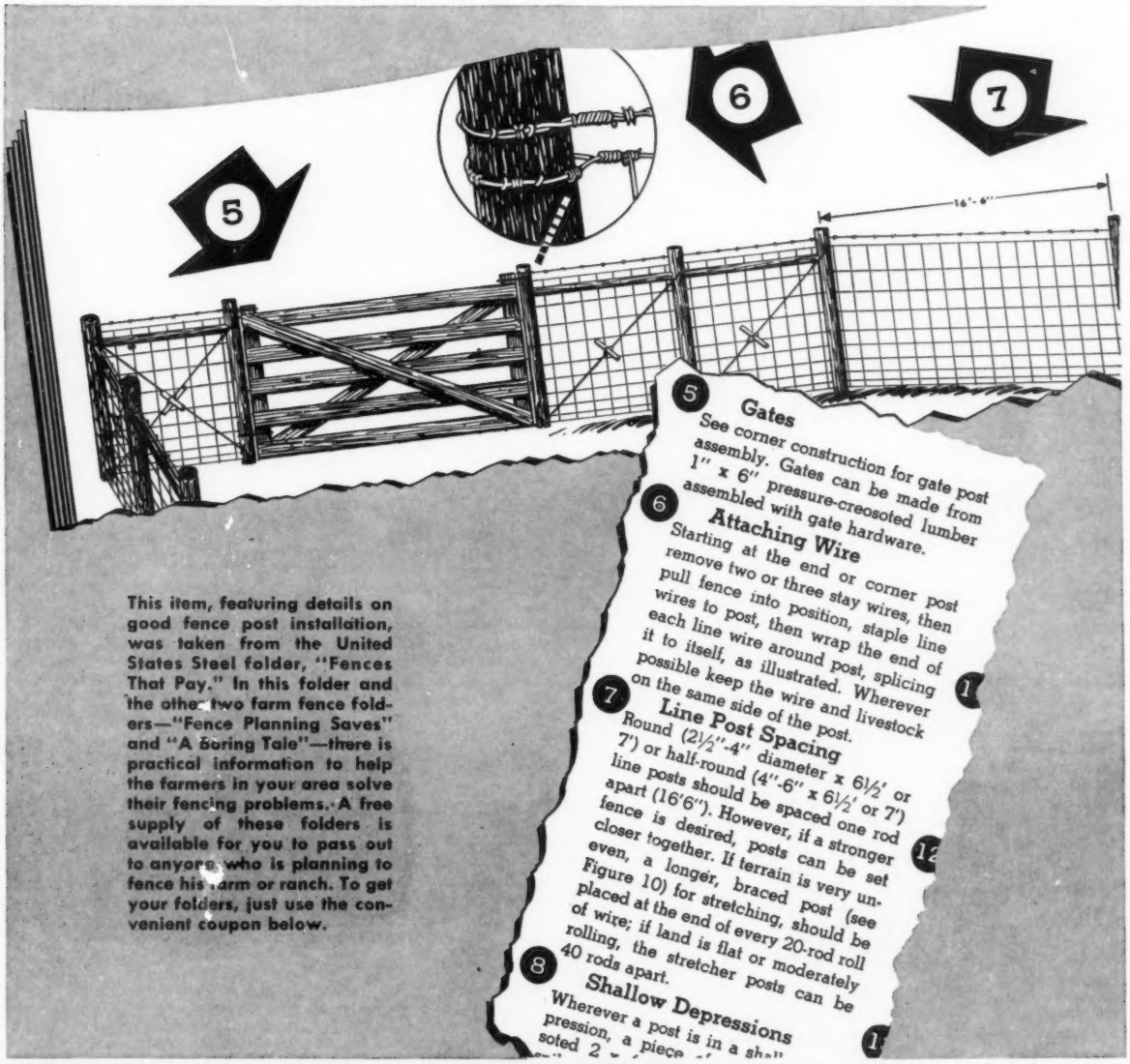
(Continued on page 624)

for the farmers and ranchers in your area:

TIPS ON BETTER FARM FENCING

No. 3

FROM UNITED STATES STEEL



This item, featuring details on good fence post installation, was taken from the United States Steel folder, "Fences That Pay." In this folder and the other two farm fence folders—"Fence Planning Saves" and "A Boring Tale"—there is practical information to help the farmers in your area solve their fencing problems. A free supply of these folders is available for you to pass out to anyone who is planning to fence his farm or ranch. To get your folders, just use the convenient coupon below.

5 Gates

See corner construction for gate post assembly. Gates can be made from 1" x 6" pressure-creosoted lumber assembled with gate hardware.

6 Attaching Wire

Starting at the end or corner post remove two or three stay wires, then pull fence into position, staple line wires to post, then wrap the end of each line wire around post, splicing it to itself, as illustrated. Wherever possible keep the wire and livestock on the same side of the post.

7 Line Post Spacing

Round (2½"-4" diameter x 6½' or 7') or half-round (4"-6" x 6½' or 7') line posts should be spaced one rod apart (16'6"). However, if a stronger fence is desired, posts can be set closer together. If terrain is very uneven, a longer, braced post (see Figure 10) for stretching, should be placed at the end of every 20-rod roll of wire; if land is flat or moderately rolling, the stretcher posts can be 40 rods apart.

8 Shallow Depressions

Wherever a post is in a sha[l]low depression, a piece of [creo]soted 2 [illegible]

And when you are discussing their fence needs, we suggest you tell farmers about pressure-creosoted fence posts and how creosote, when forced deeply into wood, gives fence posts the ability to resist attack by termites, dry rot, fungi, acid soils, moisture, and adverse weather conditions. In many cases, properly treated fence posts have lasted 30 and more years. Farmers should know the importance of buying fence posts which have been pressure-creosoted, not just superficially treated or painted.

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UNITED STATES STEEL

Agricultural Extension
United States Steel Corporation
525 William Penn Place, Pittsburgh 30, Pa.

Please send me a free supply of the United States Steel folders on pressure-creosoted wood.

Name.....

Address.....

City.....**State**.....

ASAE Members In The News

(Continued from page 622)

Roger Yoerger has accepted a position on the staff of the agricultural engineering department at Pennsylvania State University, University Park. Formerly he was assistant professor of agricultural engineering at Iowa State College in Ames.

•

H. Keith Garrison, an engineer in the industrial research division of Doane Agricultural Service, St. Louis, Mo., has accepted a position with the Minnesota-Iowa division of the Green Giant Co. in LeSueur, Minn.

Marvin Marmorine has been promoted from plant engineer to division engineering manager of the Minnesota-Iowa division of the Green Giant Co., LeSueur, Minn.

•

Frederick H. Buelow has joined the staff of the agricultural engineering department at Michigan State University, as assistant professor. His new duties will deal principally with research in automation and solar energy applications. He received a B.S. degree in agricultural engineering at North Dakota Agricultural College, an M.S. degree at Purdue University, and in June, 1956, he obtained a Ph.D. degree in agricultural engineering from Michigan State University.

NECROLOGY

Arnold P. Yerkes, a past-president and life member of ASAE, died August 13 in Washington, D. C.

A. P. YERKES

Mr. Yerkes was born on a farm near Davisville, Bucks County, Pa., in 1885. His formal education was obtained in the local schools, a business college and one year at the Franklin Institute in Philadelphia. He spent three years each in the office of the inspector of ordnance, U.S. Army, at the Midvale Steel Works, and in the small arms and equipment division of the Army. While with the ordnance division he devised a correspondence system for writing and filing which has saved much government expense and human attention.

In 1912 he entered the Office of Farm Management, U.S. Department of Agriculture, as a scientific assistant in agronomy, farm equipment division. By 1915 he was made division head. During World War I he served as assistant to the Farm Equipment Administrator in allocation of materials to the industry. He was appointed as captain in the ordnance department, U.S. Army, shortly before the armistice was signed.

He joined the International Harvester Co. in 1918 where he remained until his retirement in 1950. In 1942 he was appointed as a dollar-a-year man to the Farm Equipment Section of the War Production Board and the following year he was collaborator for the U.S. Department of Agriculture consulting with the Food Production Administration and the War Food Administration. For many years after joining International Harvester he was editor of *Tractor Farming* and *Canadian Tractor Farming*. Through these publications he gave wide circulation to numerous agricultural-engineering contributions, and is credited with having exerted a tremendous influence on power-farming practices and development of the farm tractor. In 1938 he was made editor-in-chief of the company's advertising department and in 1940 he became general supervisor of farm practice research.

Mr. Yerkes joined ASAE in 1918, served as president in 1937-38 and was chairman of the Power and Machinery Division in 1925-26. He was awarded the Cyrus Hall McCormick Medal by the Society in 1950.

He is survived by his wife, Rebecca, and three daughters.

Peter T. Montfort, professor of agricultural engineering, Texas A & M College and a vice-president of ASAE, died in Bryan, Texas, July 23, after an illness of several months. He was a native of Texas and attended Corsicana High School and Texas A&M College. He received a B.S. degree in agriculture in 1921, majoring in agricultural engineering.

P. T. MONTFORT

Following graduation he operated his own farm in North Texas for five years, returning to Texas A & M in the fall of 1926 to do graduate work. A large part of his graduate work was spent in designing, constructing and testing a portable hay drier. He also assisted in a rural electrification survey conducted at that time.

In January, 1928, he became assistant secretary of the Texas Hardware and Implement Association. In November of the same year, he returned to the agricultural engineering department at Texas A & M as project director of the Texas Committee on the Relation of Electricity to Agriculture. He served in that capacity until his death, with the exception of 1933 and 1934, when he was a county agricultural agent in West Texas.

He had made an outstanding record in his field, and his accomplishments and reputation were recognized in Texas and throughout the nation. As a result of his efforts, most of the electric power companies in Texas, and others outside the state, have organized and developed effective rural service departments.

Mr. Montfort made many valuable contributions to farm electrification research and extension where he directed studies in farm refrigeration, chicken brooding, egg cooling, hay and grain drying, feed processing, and food preservation.

A member of the ASAE since 1928, he had served on its Council and had been active in the Rural Electric Division. He has occupied all of the offices in this Division and served regularly on one or more of its committees. He was elected vice-president of the Society, term beginning in June, 1956.

He has been the author of a number of papers on various phases of farm electrification. He was a member of Tau Beta Pi.

With the ASAE Sections

Michigan Section

A meeting of the Michigan Section will be held October 13 at Michigan State University, East Lansing. Registration will begin at 9:00 a.m. A. W. Farrall, head, agricultural engineering department, Michigan State University, will welcome the group at 9:45 a.m. The program will begin with the presentation of a paper on plant nutrient radio active tracers by Dr. K. Lawton, MSU soils science department. Two other papers will be presented; one on the status of food irradiation and the other, with a catchy title, "Wear Does Your Metal Go?"

R. J. Alpers, section chairman, will give a short talk on the progress of a new ASAE membership drive, and will explain the method he has used successfully in obtaining 26 membership applications in the past three months. T. J. Wilkinson will conclude the morning session with a movie. In the afternoon the group will attend a football game between MSU and University of Indiana.

Tennessee Section

A meeting of the Tennessee Section will be held November 16-17 at the University of Tennessee, Knoxville. Tentative plans call for registration at 9:00 a.m., Friday, November 16, and the first session to begin at 10:00 a.m. at McCord Hall at the University Farm.

Subjects concerning all major branches of agricultural engineering are included in the program and a panel discussion will be held on the educational aspects of agricultural engineering. A cafeteria-style dinner and meeting are planned for the evening.

A tour of the Alcoa Aluminum Plant is scheduled for Saturday morning and the meeting will conclude with a football game between the University of Tennessee and University of Mississippi (Ole Miss).

North Carolina Section

A meeting of the North Carolina Section was held September 5 and 6 at Camp Millstone, located 12 miles north of Rockingham, N. C. The program consisted of an afternoon session, a business meeting and an evening dinner on Wednesday and three field trips on Thursday.

Two papers were presented during the Wednesday afternoon session. Thomas L. Reeves, owner and operator of a large dairy operation, spoke on experiences in developing a mechanized dairy operation. The second paper was presented by J. F. Kelly and E. H. Frazier, Jr. of Aeroglide Corp., Raleigh, on the engineering problems in designing a 100,000-bu commercial elevator for North Carolina conditions. R. M. Ritchie, Jr., chairman of the North Carolina Section, presided at the business meeting held at 4:00 p.m. Dinner was served in the dining hall at 6:00 p.m.

On Thursday the group toured the Choplin Feed Mill at Rockingham, where members became acquainted with design and operation of a small feed mill. From there the group visited the Seaboard Air Line railroad terminal at Hamlet, where they observed the operation of classification of freight cars handled entirely by electrical controls. In the afternoon a trip was made to a cannery at Aberdeen to observe an up-to-date cannery designed to process fruits and vegetables.

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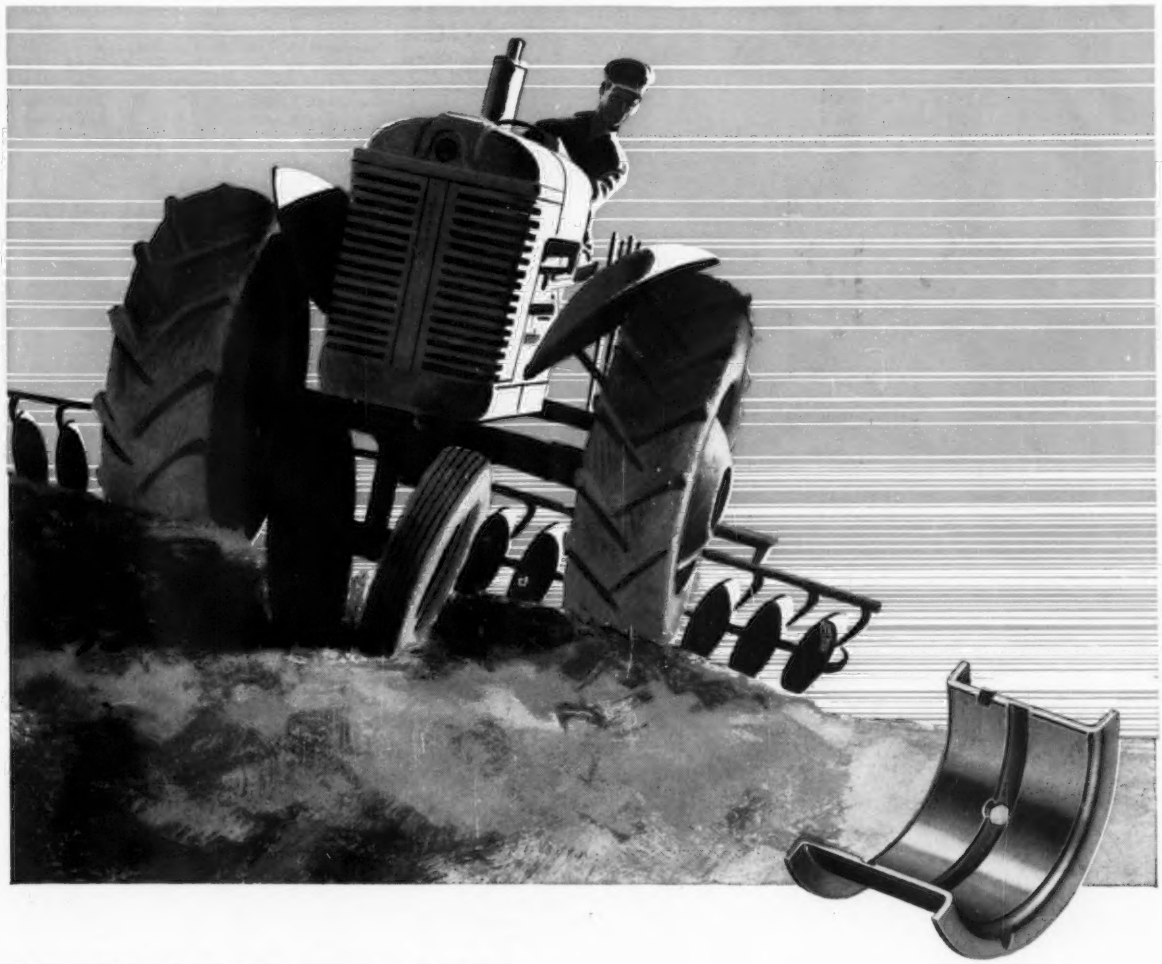

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Ingenious mechanical equipment has solved the labor problem for today's farmer. But his first requirement of any unit is dependability of operation—around the clock if need be—in his constant battle with nature. Federal-Mogul bearings have been assuring dependability in farm tractors and implements for generations. The same dependability characterizes Federal-Mogul bearings in any application, from automobiles to construction equipment—dependability that is the product of over 50 years' highly specialized bearing manufacture.

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NEW PRODUCTS CATALOGS

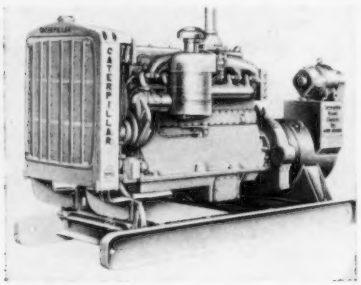
Self-Propelled Automatic Baler

New Holland Machine Co., New Holland, Pa., has developed a self-propelled automatic hay baler designed especially for the average-size farm. Powered by two engines, one to control ground speed, the second to operate the baler, the new Model 166 is a single, complete unit. The oper-

ator is seated in full view of the entire baling operation with all controls, including separate ones for each engine, mounted within easy reach. Speeds range from a crawl to transport road speeds of over 11 mph. An adjustment on the baler provides for a variety in bales by weight, tightness and in any length from 12 to 52 in.

New Diesel Generator

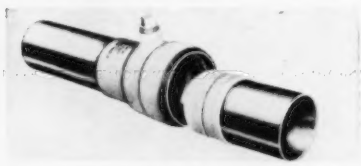
Caterpillar Tractor Co., Peoria, Ill., has developed a new 100-kw self-regulated diesel electric power generating set. Known as the D342, the new unit has been designed and built specifically to match the D342 diesel engine. It features close voltage regu-



lation and is said to be capable of filling the needs of many applications now served by externally-regulated units. Voltage drop and terminal voltage can be adjusted on the new generator to meet the needs of special installations. After adjustment, the controls are locked and no further adjustments reportedly are required.

Medium-Pressure Couplings

McDowell Mfg. Co., Pittsburgh, Pa., has introduced a new line of medium-pressure couplings, designed specifically for working pressures of 50 to 100 psi. These new cou-

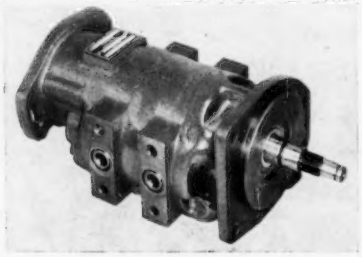


plings operate automatically by water pressure and require no hooks or latches for setting up or disconnecting of lines. They are interchangeable also wth the company's high-pressure couplings and are designed for use with its regular line of fittings. The new couplings are made in 4, 5, and 6-in sizes.

New Hydraulic Gear Pump

The Kalamazoo Division of the New York Air Brake Co., Kalamazoo, Mich., has announced a new special Hydreco Series 1500 dual gear-type hydraulic pump.

The new series pump, which operates at pressures up to 1500 psi at 2000 rpm, is designed to power steering control on both right and left hand tracks of large track-type equipment. It has a through shaft to provide drive for magnetos and other auxiliary components.



Pressure-balanced wear plates are used to keep volumetric efficiency high at all pressure. Balanced hydraulic forces on both sides of the plates are said to maintain fixed clearances between plates and gear faces so oil slippage is reduced to a fixed minimum and frictional contacts are eliminated.

The unit illustrated is designed for direct mounting on transmissions, but the company reports that many modifications of this special pump assembly are available.

Corn Header for SP Combine

The Oliver Corp., 400 West Madison St., Chicago 6, Ill., has announced a new corn header for the Model 35 self-propelled grain combine. The new header performs three operations in one — picks, shells and shreds — in a single operation.

Features of the new header include heavy-duty roller-type gathering chains, a belt-type rubber feed apron, a 5495 sq-in threshing unit, flexibility for 38 to 42-in rows, and quick interchangeability of corn and grain headers.

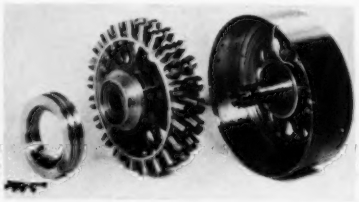
Hose Accessory Catalog

Hose Accessories Co., 2700 N. 17th St., Philadelphia 32, Pa., announces publication of an 8-page illustrated catalog of the company's products.

The catalog covers the Le-Hi line of hose couplings, hose clamps, hose nipples, valves and manifolds used for tunneling, mining, quarrying, contracting, construction and general industry applications. It also includes the size and classification, and the parts numbers.

Adds Magnetic Drives to Line

Whitney Chain Co., Hartford, Conn., announces the completion of licensing agreements with Tormag Transmissions, Ltd. of Vancouver, B.C., Canada, covering the manufacture by Whitney Chain Co. of a completely new product line consisting initially of magnetic drives and ultimately including variable-speed speed reducers.



The magnetic drive provides a flexible slip-type drive between a motor and its load, in a range from fractional to over 50 hp. The cylindrical design of the drive permits the unit to be smaller in diameter than an electric motor of similar horsepower. It consists of a magnetic rotor, which is a cylinder to which are attached permanent magnets; and a bimetallic rotor, which is a copper-faced, mild steel plate or cylinder perforated with steel rivets.

In basic form, these two rotors are mounted face-to-face with an air space between them. If either of the rotors is driven, a torque is induced in the other through eddy currents, with the permanent magnets supplying magnetic flux. The driving and driven rotors are never in contact — the air-gap always exists between them.

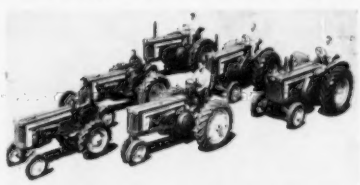
The design of the magnetic drive is said to permit variations to cover a wide range of transmission problems involving synchronous drives, variable speed-variable torque output, or variable speed-constant torque output.

New Tractor Line Has New Look

Deere & Co., Moline, Ill., has announced its new John Deere tractor line which includes six power sizes and thirty basic models, all with a new look in a new two-tone color styling in green and yellow. The company reports that the complete range of power sizes and models is engineered to meet specific farming needs in every part of the country.

The latest addition to the line is the new 1 to 2-plow 320 series available in standard and utility models. Regular equipment on both models includes single hydraulic system, standard 3-point hitch with load-and-depth control, and full wheel-tread adjustments, front and rear. The series is powered by a 2-cylinder vertical, valve-in-head, engine with a 4-in bore and 4-in stroke.

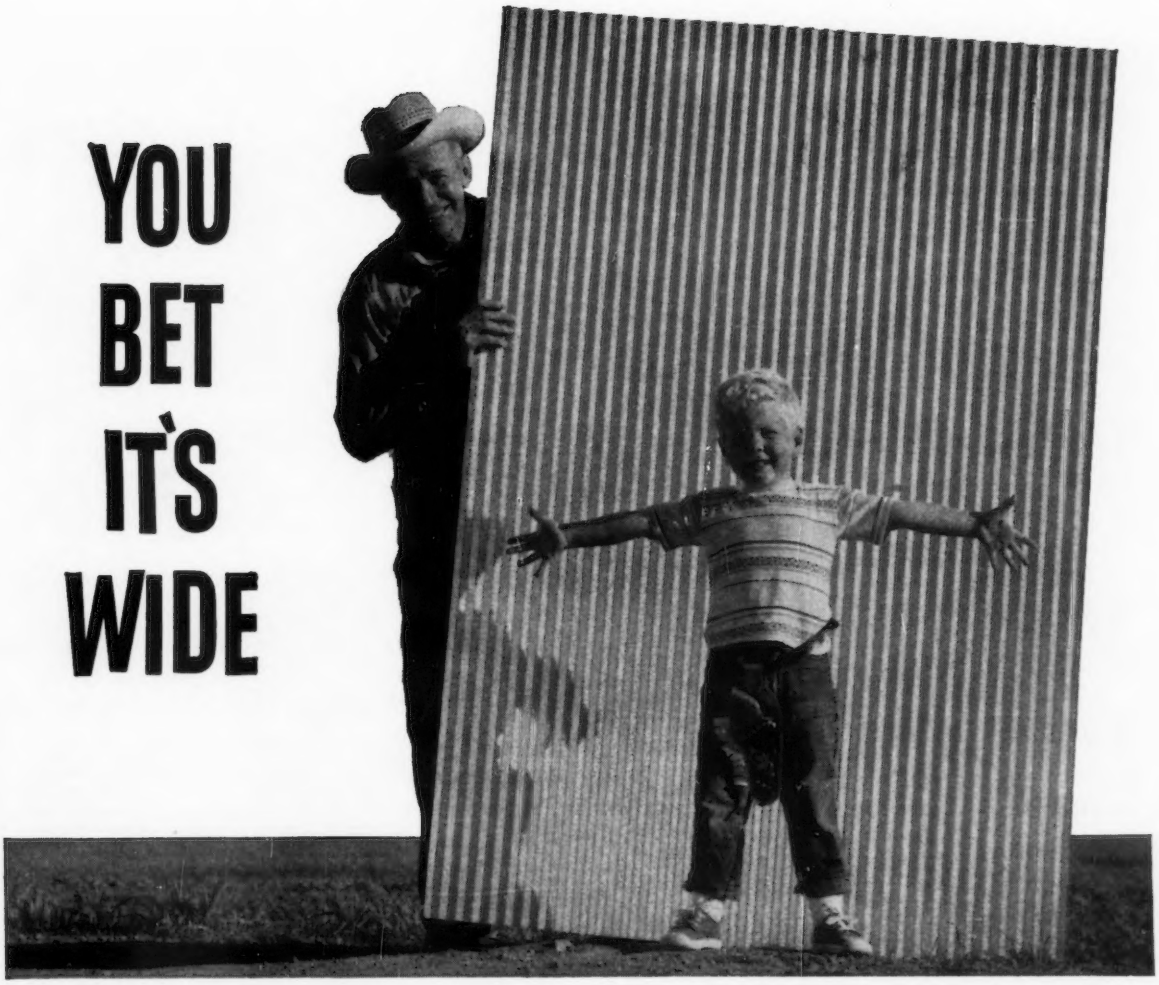
The 420 series consists of six 2 to 3-plow



wheel-type models and two 3 to 4-plow track-type models. Additional features in the wheel-type models include a new 5-speed transmission and a new continuous-running PTO, as optional equipment. A new 3-point hitch, new 5-speed transmission, new direc-

(Continued on page 628)

YOU BET IT'S WIDE



New 48-Inch Wide Kaiser Aluminum Roofing Sheets Save Farmers Money

THESE big sheets cut roofing time drastically. They go up faster and easier because there's only one lightweight sheet to handle instead of two. Fewer side laps save metal over narrower width sheets—make a "tighter" roof.

Like all Kaiser Aluminum roofing, the new 48"-wide sheets reflect hot sun rays to keep interiors as much as 15° cooler in summer. They won't rust or rot—never need paint. Attractive embossed finish diffuses light reflection to reduce glare.

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New Products and Catalogs

(Continued from page 626)

tion reverser, and new foot throttle are optional equipment on the track-type models.

The 520, 620, and 720 series retain the basic 2-cylinder engine design, but have increased power. In factory tests on gasoline, the 3-plow 520 developed about 36 belt hp; the 4-plow 620 developed about 48 belt hp; and the 5-plow 720 developed about 58 belt hp. These tractors provide a wide choice of models and front-end assemblies. Either LP-Gas or gasoline engines are available for all three, and a diesel engine is available in the 720 series. A new feature of tractors in these three series is an advanced hydraulic system that offers a choice of one, two or three circuits, each controlled by a separate lever. A new independent PTO is designed to deliver full engine horsepower independent of the transmission clutch and hydraulic system, and power steering is available on all three.

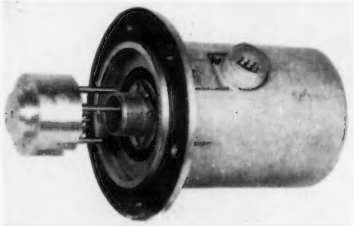
The 5 to 6-plow 820 Diesel is the successor to the 80 Diesel, with the same engine. The starting engine has been quieted with a new exhaust, fenders have been widened, brake capacity increased, and power steering is available.

Catalog Describes New Front-End Spreader

Allis-Chalmers Mfg. Co., has published a new catalog No. TL-1625, which describes the company's new No. 110 front end manure spreader. Copies are available to readers upon request to the company.

Slip Ring Assembly Transmits Stresses

Avco Manufacturing Corp., Stratford, Conn., has designed a new type slip ring assembly to obtain data on stresses of rotating parts while in operation. The assembly may be built in different sizes depending



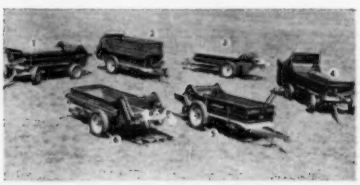
upon requirements. Unit shown weighs 6 lb, has a 6-in diameter and is less than 6-in long. The new design is said to pick off readings on seven circuits (14 rings), operate up to 5,000 rpm and transmit any signal or change of signal whether through thermocouples or strain gages.

New Line of Spreaders and Forage Boxes

New Holland Machine Co., New Holland, Pa., has introduced a new line of spreaders and forage boxes. Six new models for spreading and hauling forage have been developed from two basic capacity machines —100 and 130 bu.

Most versatile in the line are the 130-bu machines which can be converted into self-unloading forage boxes and bunk feeders. The Model 330 is a PTO model with two wheels while the Model 335 has the same features but is provided without undercarriage. It can be mounted on a wagon or on a truck, as shown in upper illustration.

Both models can be converted to forage boxes by adding high sides and mixing hoods. They can also be used as bunk feeders by adding a cross conveyor on the rear. A new control replaces the lever to adjust apron and beater speed. A rope attached to the tractor seat is pulled by the operator to shift speeds.



The other two of the six machines are 100-bu spreaders—PTO-drive Model 220, and ground-drive Model 200.

Shown clockwise in lower illustration are: (1) Model 335 mounted on a wagon; (2) Model 330 self-unloading forage box; (3) Model 330 as 130-bu spreader; (4) Model 335 (shown without sides) as forage box with cross conveyor; (5) Model 200 ground-drive spreader; (6) Model 220 PTO spreader.

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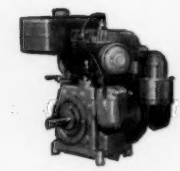
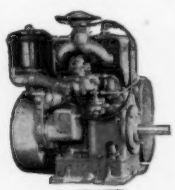
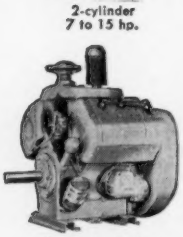
Write for Engine Specifications Bulletin S-188, and a copy of our complete list of approved service stations throughout the world.



4-cycle single cyl., 3 to 9 hp.



2-cylinder 7 to 15 hp.



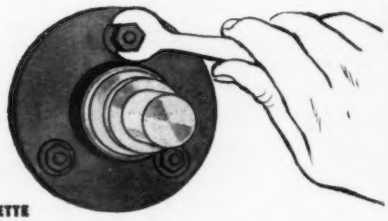
V-type 4-cylinder 15 to 36 hp.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

A 8751-½-IAA

PROGRESS POINTS *in the design of farm equipment*

Two Fafnir Flangettes are visible at the drive end of the tailings and clean grain auger in this closeup of the John Deere 45 Self-Propelled Combine. A third (top) is mounted on the opposite drive end of the straw walker cranks and a fourth (right) is installed on the straw chopper.



THE FLANGETTE

LOW-COST SEALED-BEARING "PACKAGE" CUTS PRODUCTION COSTS

Typical of the way Fafnir anti-friction bearings have been economically incorporated into the design of modern farm equipment is the use of the famous Flangette at important turning points in the John Deere 45 Self-Propelled Combine.

SAVES TIME AND MONEY ON THE JOB

The Flangette — versatile ball bearing "package" with permanently sealed-in lubricant — is widely used in farm equipment because of its low cost, and ease and economy of installation. What's more, it is highly regarded by farmers because it is sealed against dirt, chaff, and other abrasives that cause premature wear and bearing failure. In addition, the Flangette requires no relubrication, thus saving valuable man and machine time for productive work.

Perhaps Fafnir Flangettes can help *you* cut costs, speed assembly, and improve operating efficiency of farm equipment. Flangettes are available with either Mechani-Seals (slinger type), or Plya-Seals (contact type). Your letterhead will bring you complete information. The Fafnir Bearing Company, New Britain, Connecticut.

The John Deere 45, equipped with Fafnir ball bearings, keeps harvest costs low by staying "on the go".

FAFNIR
BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Alexander, Edward L. — Engineering specialist, (SCS) USDA (Mail) 604 E. Mesquite, Uvalde, Texas

Amspaugh, Daniel F. — Senior draftsman, New Idea Farm Equipment Co. (Mail) Box 394, Ansonia, Ohio

Andrews, Vern H., Jr.—Service supervisor, Ferguson Div., Massey-Harris-Ferguson, Inc. (Mail) 15001 Greenfield Rd., Detroit 27, Mich.

Atkins, Glen R.—Partner, Wolverine Trenching Service (Mail) RR 3, Fennville, Mich.

Brown, Ross K.—Engineering trainee, John Deere Waterloo Tractor Works (Mail) 2535 East 4th St., Waterloo, Iowa.

Cleaves, Arthur T.— Test engineer, East Moline Works, International Harvester Co. (Mail) 1163 19th St., Moline, Ill.

Colby, Clark K., Sr.—Drain commissioner, Shiawassee County (Mail) RR 1, Laingsburg, Mich.

Cole, Hinson C. — Soil conservation engineer, District Public Works Office, First Naval District (Mail) 64 Sagamore St., So. Braintree, Mass.

Collins, Robert E. — Irrigation engineer (SCS) USDA (Mail) General delivery, Spearman, Texas

Craig, Olin L., Jr.—Farmer (Mail) Cateechee, S. C.

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"Our Morlife clutches need only one tenth as many adjustments as former clutches"

*TRADE MARK

"MORLIFE clutch has gone 851 hours without slipping or adjustment."

"MORLIFE clutch going strong after 1695 hours, working in sand."

"MORLIFE clutches last 950 hours longer, without adjustment."

"MORLIFE clutch needs adjustment once a month, instead of daily."

"MORLIFE requires lighter handle pull and one tenth the adjustments."

"MORLIFE pulls harder and lasts six to ten times longer."

"Won't buy a unit that isn't equipped with Durable MORLIFE clutch."

New MORLIFE* CLUTCHES and CLUTCH PLATES Give-

MORE Clutch Life (400% MORE)
MORE Torque Capacity (100% MORE)
MORE Heat Resistance (50% MORE)

These *new* ROCKFORD Clutches and Clutch Plates have been developed by ROCKFORD Clutch Engineers to take full advantage of recently discovered facing material. Actual field tests on heavy duty equipment have resulted in adoption of MORLIFE clutches by builders of tractors, earth movers, graders, shovels, cranes, trucks, oil field equipment and power units. For information how these *new* Rockford MORLIFE Clutches will improve the operation and increase on-the-job hours of heavy duty machines, write Department E.

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Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

De Regnaucourt, Robert A.—Junior project engineer, New Idea Div. Avco Mfg. Corp. (Mail) 637 W. Wayne St., Celina, Ohio

Folpmers, Jan—Managing engineer, Irrigation Supply Co. (Mail) 619 Hazel St., Bakersfield, Calif.

Fraker, Charles G.—Owner and operator, trenching service (Mail) Box 68, Pompeii, Mich.

Gould, Arthur L.—Sales engineer, Michigan Vitrified Tile Co. (Mail) PO Box 668, East Side, Saginaw, Mich.

Grayden, Edward B.—Agricultural control application specialist, Minneapolis-Honeywell Regulator Co. (Mail) 6926 5th Ave. So., Minneapolis, Minn.

Hargreaves, George H. — Irrigation engineer, ICA (Mail) USAOM/ICA, APO 928, c/o PM, San Francisco, Calif.

Hartsuiker, James H.—Partner, agricultural drainage business (Mail) 444 N. Maple, Fennville, Mich.

Heyn, Walter E.—Farm drainage (Mail) Gast Road, Bridgman, Mich.

Hibbs, Frank J., Jr.—Chief engineer, Associated Refrigerating Engineers (Mail) 2100 E. Vernon Ave., Los Angeles 58, Calif.

Hirth, Harry G. — Area engineer, (SCS) USDA (Mail) Courthouse, Cheboygan, Mich.

Hobbs, William, Jr.—Designer, New Holland Machine Co. (Mail) 2137 W. Ridge Dr., Lancaster, Pa.

Hyman, Myles — Draftsman, East Moline Works, International Harvester Co., East Moline, Ill.

Jennings, Marvin D.—Product engineer, International Harvester Co. (Mail) P.O. Box 268, Memphis, Tenn.

Kesl, Elmer M. — Layout draftsman, International Harvester Co. (Mail) 2524 Westover Ave., No. Riverside, Ill.

Kristoff, Joseph M.—Installations engineer, U.S. Air Force (Mail) 314th Installations Engineer Squadron, Sewart AFB, Smyrna, Tenn.

Krueger, Edwin G.—Senior project engineer, New Idea Farm Implement Co. (Mail) 133 Wagner Ave., Greenville, Ohio

Langford, LeRoy — Product engineering trainee, Allis-Chalmers Mfg. Co. (Mail) 202 Hoke St., East Gadsden, Ala.

Main, Ralph A.—Consulting engineer, Main Engineers, 355 Henrietta St., Birmingham, Mich.

McAlexander, James E. — Sales engineer, Dixie Irrigation Co. (Mail) Shady Acres Trailer Park, RR 6, Shepherd Rd., Chatanooga, Tenn.

McClellan, Wayne L.—Assistant sales manager, John Deere Van Brunt Co., Horicon, Wis.

McHenry, James R. — Junior project engineer, New Idea Div., Avco Mfg. Corp. (Mail) 224 W. Anthony St., Celina, Ohio

McKeon, Charles E. — Research engineer, Tractor and Implement Div., Ford Motor Co. (Mail) 1481 East Lincoln Avenue, Birmingham, Mich.

Maxwell, John M.—Product engineer, J. I. Case Co., Anniston, Ala.

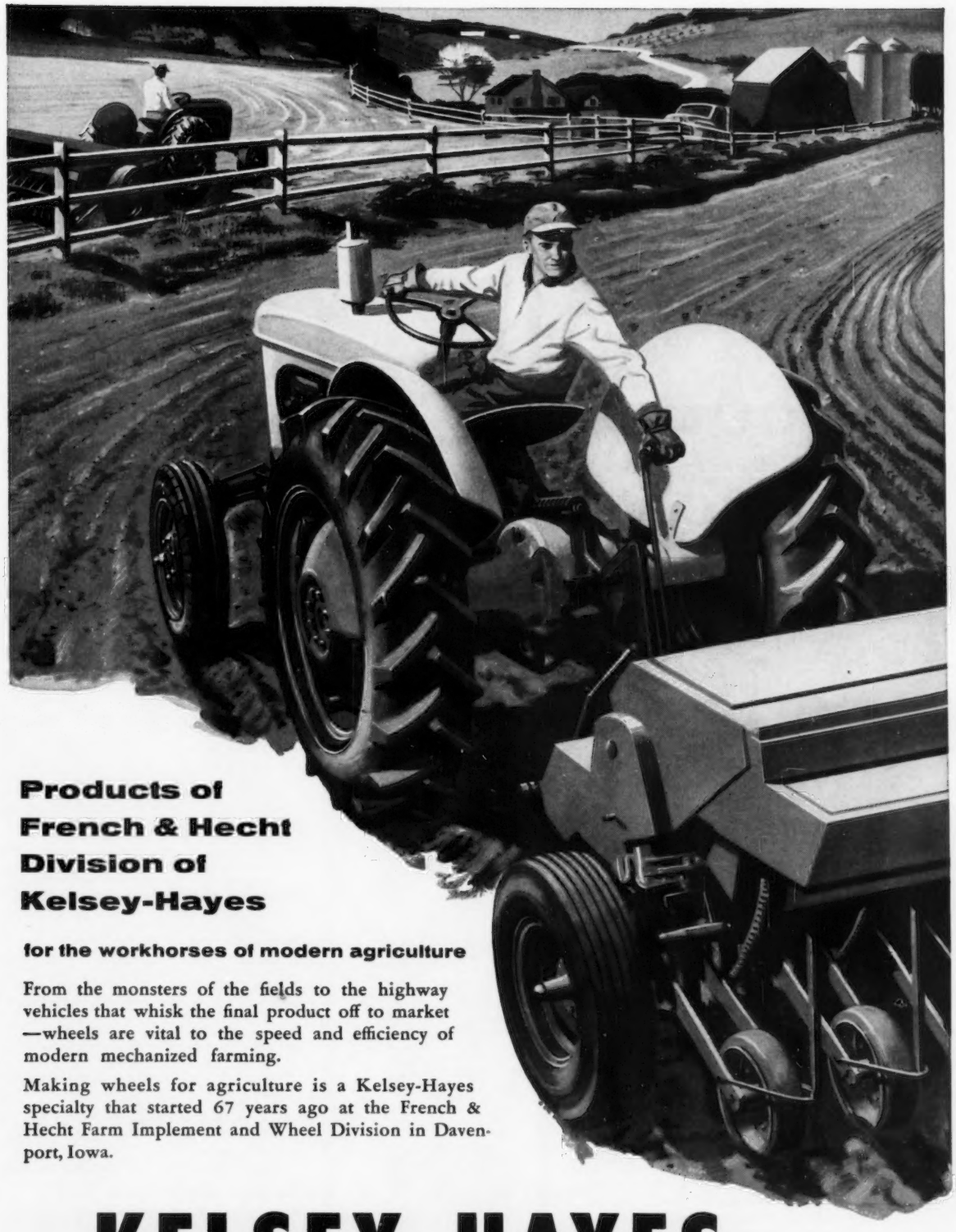
Morgan, Ora B., Jr. — Graduate student, North Carolina State College (Mail) UK 32 Vetville, Raleigh, N. C.

Mullen, T. L.—Vice-president and chief engineer, Rome Plow Co., Cedartown, Ga.

Myers, Roscoe E.—General manager, Blood Bros. Machine Div., Rockwell Spring & Axle Co., Allegan, Mich.

Oest, Elvert E. — Assistant engineer, Allis-Chalmers Mfg. Co. (Mail) 10401 W. Greenfield Ave., West Allis 14, Wis.

(Continued on page 632)



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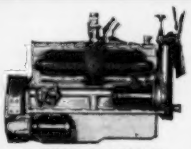
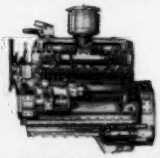
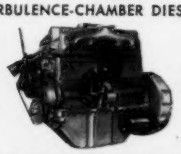

L-HEAD GASOLINE

OVERHEAD-VALVE GASOLINE


TURBULENCE-CHAMBER DIESEL


DIRECT-INJECTION DIESEL

TURBOCHARGED DIESEL

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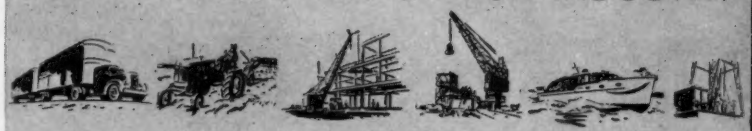
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Write for more information on any of these dependable power plants. Our sales-engineers will be happy to help solve your power problems. No obligations, of course.

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MARINE DIESELS

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Engine Specialists Since 1915 • Canton, Ohio

Applicants for Membership

(Continued from page 630)

Pursell, Charles K. — Test engineer, farm tractor engr. dept., International Harvester Co. (Mail) 826 So. Wabash Ave., Chicago 5, Ill.

Randolph, Dale F. — Owner, Randolph's Digging Service (Mail) RR 3, St. Johns, Mich.

Rettig, Vernon E.—Student engineer, John Deere Des Moines Works (Mail) General delivery, Ankeny, Iowa

Riffe, Glenn E.—Design engineer, East Moline Works, International Harvester Co. (Mail) YMCA, Moline, Ill.

Robinson, Joe N. — Student, agricultural economics (Mail) Route 3, Box 138, Naples, Tex.

Scott, Dale K.—Oxford, Mich.

Seymour, Shaun A.—Engineer trainee, New Holland Machine Co. (Mail) Box 523, Leola, Pa.

Shalhevet, Joseph — Assistant in research, dept. of agronomy, Cornell University, Ithaca, N. Y.

Smith, Harley L. — Sales manager, Pacific Supply Cooperative (Mail) Box 1004 Walla Walla, Wash.

Smith, Harold M. — Owner and drainage contractor, Smith Brothers (Mail) 420 North Ovid St., Elsie, Mich.

Smith, Oliver — Owner and drainage contractor, Smith Brothers (Mail) 115 W. Oak St., Elsie, Mich.

Smith, Traver J.—Vice-president in charge of sales, Magnuson Engineers, Inc., 509 Emory St., San Jose 10, Calif.

Steingas, Richard R. — Design engineer, Minneapolis-Moline Co. (Mail) 1914 Eustis St., St. Paul 8, Minn.

Stilwell, Jack E.—Jr. engineer, product design, John Deere Des Moines Works (Mail) 7303 Airline, Des Moines, Ia.

Stone, Thomas W. — Rural representative, Western Massachusetts Electric Co., 73 State St., Springfield 2, Mass.

Straub, William B.—Student trainee, development dept., Firestone Tire & Rubber Co. (Mail) 1275 N. Main St., Akron 10, Ohio

Strayer, Irvin W.—Junior project engineer (Mail) New Idea Div., Avco Mfg. Corp., Coldwater, Ohio

Switzer, Wm. F.—Assistant engineer, G. E. Smith Const. contractor (Mail) 207½ Crane Dr., Crawfordsville, Ind.

Thompson, Herbert F.—Rural area specialist, Central Louisiana Electric Co., Inc. (Mail) 715 Main St., Pineville, La.

Ussery, L. Roy — Agricultural engineer, (SCS) USDA (Mail) PO Box 663, Brownwood, Texas

Van Peursem, Marvin D.—Product engineer, John Deere Des Moines Works (Mail) Mitchellville, Ia.

Waund, Dunrith, Jr. — Trainee, Hawaiian Sugar Planters Assn., Experiment Station, HSPA, Honolulu, Hawaii

Westcott, Irving E. — Owner and operator, agricultural drainage (Mail) RR 2, Bangor, Mich.

Wirth, Robert A.—Trainee, product engineering, East Moline Works, International Harvester Co. (Mail) YMCA, Moline, Ill.

Yazdi, Mehdi—Irrigation engineer (Mail) Saadi Ave., Ardekani Bldg., Teheran, Iran

Young, John R.—Research engineer, Blood Brothers Machine Div., Rockwell Spring & Axle Co., Allegan, Mich.

Transfer of Membership

Aakre, Richard B. — Assistant professor, University of Minnesota, North Central School and Experiment Station (Mail) N.C. Exp. Station, Grand Rapids, Minn. (Affiliate to Member)

(Continued on page 634)

PEORIA MALLEABLE CASTINGS "have a hand in the harvest" with GLEANER-BALDWIN COMBINES

Famous for performance and stamina, the Allis-Chalmers Gleaner-Baldwin line of combines is noted for its high quality construction. At many important points Peoria Malleable Castings are used.

Peoria Malleable castings provide an attractive part that is durable and dependable. And, very often, their cost is less than the labor and material involved in making a weldment or a forging.

Write for complete information. If you would like a definite quotation, at no obligation, enclose specifications with your letter.

A Gleaner-Baldwin self-propelled combine provides fast, efficient harvesting on this Midwestern farm.

A big part of **QUALITY** *is a* **QUALITY** *part*

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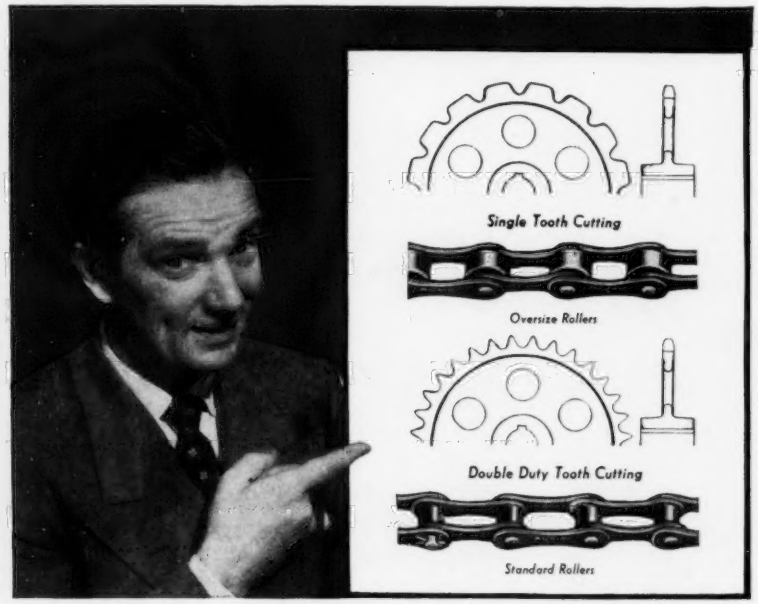
PEORIA MALLEABLE CASTINGS CO.

FT. OF ALEXANDER ST., PEORIA, ILLINOIS

FAMOUS FOR **QUALITY**



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Here is double pitch chain applied on both a single and double duty tooth form sprocket. The single duty sprocket is necessary for use with double pitch chains using oversize rollers. The double duty sprocket used with double pitch chain having standard diameter rollers, has another 'life' by simply moving the chain up one tooth after it is worn in its first position. Double duty cutting in many cases, doubles the life expectancy of a sprocket.

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Applicants for Membership

(Continued from page 632)

Bigalow, Ivan E.—Consultant, farm structures, C. H. Hood Dairy Foundation, Boston, Mass. (Mail) 50 McArthur Rd., Stoneham, Mass. (Affiliate to Member)

Borpujari, Dulal—Test engineer, Test Engr. Dept. 74, International Harvester Co., Melrose Park, Ill. (Associate to Member)

Clayton, J. T.—Assistant professor of agricultural engineering, University of Illinois, Urbana, Ill. (Associate to Member)

Cumming, Alexander—Agricultural development officer, Dept. of Agriculture, Federation of Malaya (Mail) PO Box Parit, Perak, Malaya (Affiliate to Associate Member)

Curtis, James O.—Assistant professor, Agricultural Engr. Dept., University of Illinois (Mail) 505 South Victor, Champaign, Ill. (Associate to Member)

Dahnert, Duane R.—Special representative, engineer in rural sales promotion activities (Mail) RFD 1, Mendota, Ill. (Associate to Member)

Evans, Norman A.—Assoc. professor and assoc. agr. engr., Colorado A & M College, Fort Collins, Colo. (Associate to Member)

Forth, Murray W.—Development engineer, product development dept., Deere & Co., Moline, Ill. (Associate to Member)

Garrett, Donald M.—Irrigation engineer, Portable Aluminum Irrigation Co. Inc. (Mail) 128 Eaton Way, Vista, Calif. (Affiliate to Associate)

Harrington, Roy E.—Project engineer, product development dept., Deere & Co. (Mail) 301 Third Ave., Moline, Ill. (Associate to Member)

Hollingsworth, J. P.—Agricultural engineer, Farm Electrification Section, USDA (Mail) Agr. Engr. Dept., Texas A & M College, College Station, Tex. (Associate to Member)

Huston, Willis E.—Extension engineer, University of Georgia (Mail) Extension Service, Extension Bldg., Athens, Ga. (Associate to Member)

Johnson, Howard K.—Research engineer, Cargill, Inc., Minneapolis 15, Minn. (Associate to Member)

Jones, Benjamin A., Jr.—Assistant professor, Agr. Engr. Dept., University of Illinois, Urbana, Ill. (Associate to Member)

Liljedahl, Louis A.—Project leader, Weed Control Machinery Research Project (Mail) 4137 31st Ave. South, Minneapolis 6, Minn. (Associate to Member)

Mahoney, George W. A.—Assistant professor, Oklahoma A & M College (Mail) 523 N. Washington St., Stillwater, Okla. (Associate to Member)

Morgan, Leland E.—Product planning analyst, Tractor & Implement Div., Ford Motor Co., 2500 East Maple Rd., Birmingham, Mich. (Associate to Member)

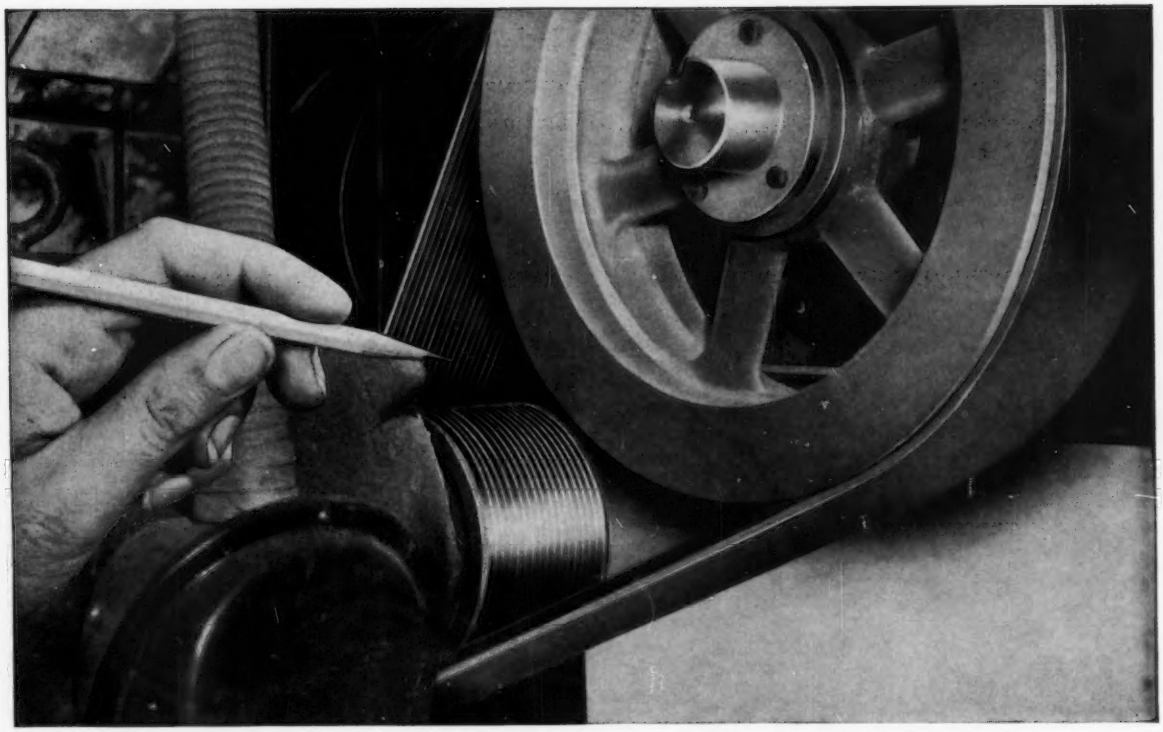
Morrison, Stanton R.—Rice officer, Dept. of Agriculture, Belize, British Honduras (Associate to Member)

Oyler, Ralph L.—Product analyst, Tractor and Implement Div., Ford Motor Co. (Mail) 3617 Rochester Rd., Birmingham, Mich. (Associate to Member)

Paul, Edwin A.—Field engineer, Chain Belt Co., Springfield, Mass. (Associate to Member)

Steinke, Alfred W.—Agricultural engineer, U.S. Bureau of Reclamation (Mail) 1134 West Ave. B, Bismarck, N. D. (Associate to Member)

Walker, Richard P.—Assistant agricultural engineer, Rice Experiment Station (Mail) PO Box 492, Crowley, La. (Associate to Member)



This Space Saving Drive Solves Difficult Design Problems . . New R/M *Poly-V® Drive*

Could greater power capacity in less drive space mean an improvement in your equipment drive design? It can be done with R/M Patented Poly-V* Drive . . . R/M's totally new concept in heavy-duty power transmission! Actual installations have proved that this belt drive can deliver up to 50% *more* power in the same space as ordinary multiple-belt drives . . . or *equal* power in as little as 2/3 the space!

The unusual space-saving advantages of R/M Poly-V Drive are the result of over 5 years development by R/M engineers. Employing a single, endless parallel V-ribbed belt running on sheaves designed to mate precisely with the belt ribs, gives Poly-V Drive the strength and simplicity of flat belts *plus* the high V-groove grip of V-belts. It means you get twice the tractive surface of multiple V-belts in the same drive width . . . twice the power capacity . . . "More Use per Dollar".

OTHER IMPORTANT ADVANTAGES INCLUDE:

- Single Unit Design — Eliminates Belt Matching Problems
- More Uniform Tension — Prolongs Belt and Sheave Life
- Two Belt Cross Sections — Meet Every Heavy Duty Power Transmission Requirement
- Oil Proof, Non Spark, Heat Resistant

Investigate R/M Poly-V Drive for the improved design of both new and existing equipment. R/M engineers will gladly work with you on power transmission drive problems. Contact an R/M representative.

CONDOR V-BELTS • R/M SUPER-POWER V-BELTS

Write for Bulletin #6868 on the complete line of Condor V-Belts for regular service on conventional V-belt drives. Also write for Bulletin #6628 on R/M Super-Power V-Belts with 40% more Horsepower capacity where needed.

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RM 627

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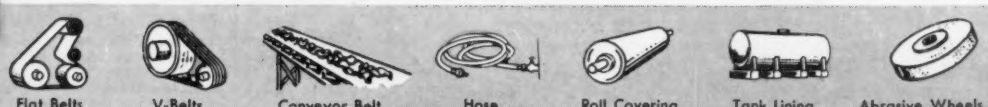

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listing.

POSITIONS OPEN — JANUARY — O-534-790. FEBRUARY—O-4-602, 6-603, 29-606. MARCH —O-60-608, 60-609, 71-611, 80-612. APRIL— O-115-614, 117-615, 117-616, 119-617. MAY— O-133-620, 155-621. JUNE—O-165-623, 166-624, 166-625, 167-626, 159-627, 142-628, 175-630, 179-631, 181-632, 181-633. JULY—O-183-634, 180-636, 198-637, 215-638, 216-639. AUGUST— O-233-640, 234-641, 219-642, 217-643, 239-644, 240-645, 241-646, 244-647, 262-648, 246-649.

POSITIONS WANTED — JANUARY — W-457-60, 528-61. FEBRUARY—W-8-1, 18-5, 30-6, 37-7. APRIL—W-50-11, 90-13, 96-14, 43-15, 53-16. MAY — W-125-17, 139-18, 143-19. JUNE — W-161-20. JULY—W-190-23, 214-25. AUGUST —W-283-26.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEER, instructor or assistant professor rank, to teach professional and service courses in electrification and structures, electrification and power machinery, or structures and power machinery. Summer assignments in extension, research or preparation for instruction, as desired. Eastern land grant university. Age, under 40. BS and preferably MS deg in agricultural engineering. Some teaching experience desirable. Ability to present subject matter, and to get along well with others. Excellent opportunity in department with expanding program. Retirement system, group insurance and hospitalization. One month vacation. Open after September 1. Salary $4200 or higher. O-271-650.

AGRICULTURAL ENGINEER for extension work in power and machinery and farm structures in an eastern state with active extension program. Work will include help with demonstration, publications, radio and television programs. BS deg in agricultural engineering. Farm background and experience in industry or educational institution desirable. Must pass physical examination. Opportunity to work on advanced degree. Opening available immediately. Salary open. O-305-651

SALES ENGINEER, with leading irrigation equipment wholesaler, for design and engineering of farm irrigation systems, dealer development, in Midwest. Graduate degree not necessary, but must have engineering experience in the soil or water field. Farm background required. Must be personable, ambitious, energetic with ability to plan and work under very little direct supervision. Guarantee salary plus commission incentive. Estimated annual earnings possible — $8,000. O-307-652

AGRICULTURAL ENGINEER. Outstanding sales opportunity for agricultural engineer who has a proved sales record and is looking for greater income. Experience in selling to dealers and distributors desirable. Age 35 to 40 preferred. Salary, expenses, and bonus. Opening available immediately. O-292-653

AGRICULTURAL ENGINEER for general manager of farm equipment division of diversified fabricating manufacturer in Midwest. To be responsible for design, manufacture and sale of products assigned to the division. Initial operation on products manufactured in plants of other divisions. Age 35-45. Agricultural engineering training and experience. Farm background desirable. Should have demonstrated superior administrative ability, and be strong in human relations. Experience in farm equipment distribution through dealer organization at top management level. Salary $15,000-25,000. O-314-654.

NEW POSITIONS WANTED

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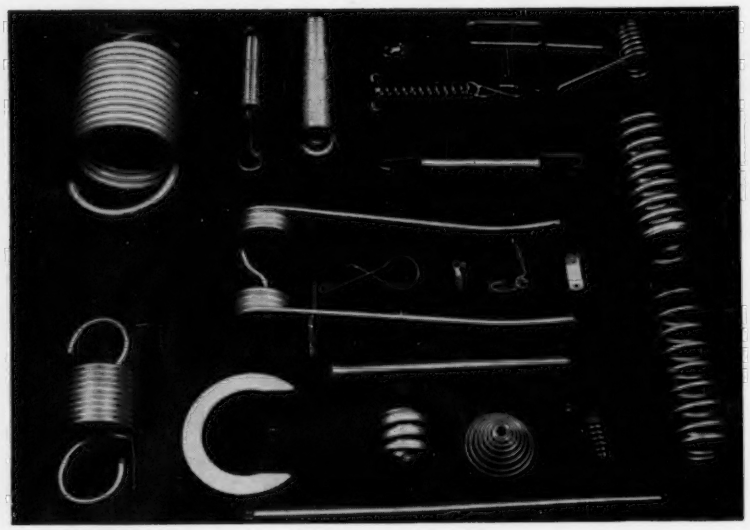

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TECHNICAL PAPER ABSTRACTS

Following are brief reviews of papers presented at ASAE meetings. Information concerning complete copies of these papers may be obtained by writing to the American Society of Agricultural Engineers, St. Joseph, Mich.

Teaching Processing Engineering, by S. M. Henderson, professor of agricultural engineering, University of California, Davis. Paper presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Education and Research Division. Paper No. **56-21.**

The author reports that agricultural processing as an area of activity is gaining in importance in agricultural enterprises. He states that only a few colleges or universities now teach courses in this subject, but many are hopeful of developing such teaching programs in the near future.

This paper describes and defines agricultural processing and its composition, outlines a proposed course for upper division agricultural engineering students, suggests laboratory exercises, and notes subareas where basic research is needed.

•

Instrumentation for Evaluating Seating Comfort on Farm Tractors, by H. Van Gerpen, research engineer, John Deere Waterloo Tractor Works, Waterloo, Iowa. Paper presented at the annual meeting in Roanoke, Va., June, 1956, on a program arranged by the Power and Machinery Division. Paper No. **56-22.**

The author reports that the criterion generally agreed upon for measuring seating comfort on farm tractors is the rate of change of acceleration or jerk. This paper describes a technique that has been devised for measuring jerk. By use of an accelerometer and a multichannel recorder an acceleration recording is made. While recording, the voltage across the pen motor is differentiated electrically and recorded on an adjacent channel as jerk. A test procedure using integrators is described which permits reduction of data to the point of being able to compare seat suspensions on a purely numerical basis. This procedure permits actual field testing over representative terrain and over a suitable period of time so as to minimize the human variable.

•

Existing State Water Legislation and That Needed to Develop Small Irrigation Projects in the Humid Areas, by Fred H. Larson, head, engineering and watershed planning unit, SCS, Upper Darby, Pa. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Soil and Water Division. Paper No. **56-23.**

The question of the legality of diverting water from streams, lakes and land surfaces is discussed as it relates to irrigation use in the humid states where the doctrine of riparian rights prevails. A short discussion of the riparian doctrine and the prior appropriation doctrine is also included.

The major portion of the paper is devoted to irrigation sources and the effect of such diversions upon downstream riparian owners and their probable attitude. Sources discussed include wells, diffused waters, streams, lakes, ponds, etc.

The paper closes with an appeal for remedial action to legalize all of these types of withdrawal.

Developing and Maintaining Airfield Runway Shoulders, by Willis H. Skrdla, agronomist, Headquarters Tactical Air Command, Langley AFB, Va. Presented at the annual meeting of ASAE in Roanoke, Va., June, 1956, on a program arranged by the Soil and Water Division. Paper No. **56-24.**

This article points out the importance of airfield runway shoulders and the difficult problems involved in establishing and maintaining satisfactory cover in various climates and areas. It is pointed out that the shoulders contribute much to the safety of an airfield by providing stability to the natural soil; dust and erosion control; variation in color between traffic and non-traffic areas; gradual slope away from the paved surface, and smooth transition at the edge of the pavement.

The establishment and maintenance of a good cover are hampered by much mechanical damage; such as, parking aircraft too close to apron shoulders for repairs; jet blast, which burns and kills the grass; inadvertent long and short landings, and lack of traffic control. This paper discusses the problems of planting and erosion control; the importance of rapid establishment of a cover; the use of mulching materials on erodible soils; the forces caused by storm water which drains off the pavement; and other types of surfacing, such as the use of oil palliatives and caleche in arid regions. Some of the more important practices recommended for several regions are described.

•

Controlled Temperature Swine Housing — A Progress Report, by E. A. Kazarian, agricultural engineering department, Michigan State University, East Lansing. Presented at the annual meeting of ASAE in Roanoke, Va., June, 1956, on a program arranged by the Farm Structures Division. Paper No. **56-25.**

During the summer of 1955, a hog feeding trial was conducted to determine the effect of improved climatic environment on the growth rate and feed efficiency of market hogs.

Six hogs averaging 35 lb were placed in each of three portable houses. One house contained double pane windows and was insulated and ventilated. The second house was similar in construction to the first with the addition of an air conditioning unit. The hogs in these two houses were confined. The control house of conventional design was provided with a concrete feed lot.

All hogs were fed the same ration with feed and water available at all times. The study was concluded when the hogs reached a weight of approximately 190 lbs. Hourly temperatures in the three houses, hourly outside temperatures and wet bulb temperatures were recorded. The weight of the hogs and feed consumption were recorded every two weeks.

Results indicated that the hogs in the air-conditioned insulated house and in the ventilated insulated house made more rapid gains than the hogs in the conventional house, but there was little difference in the gain of the hogs in the air-conditioned house as compared with the hogs in the insulated house.

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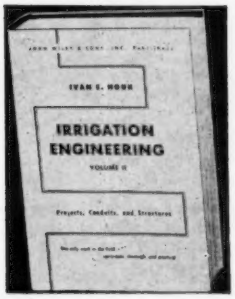

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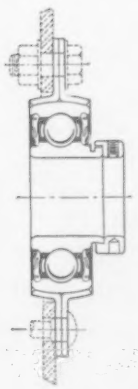

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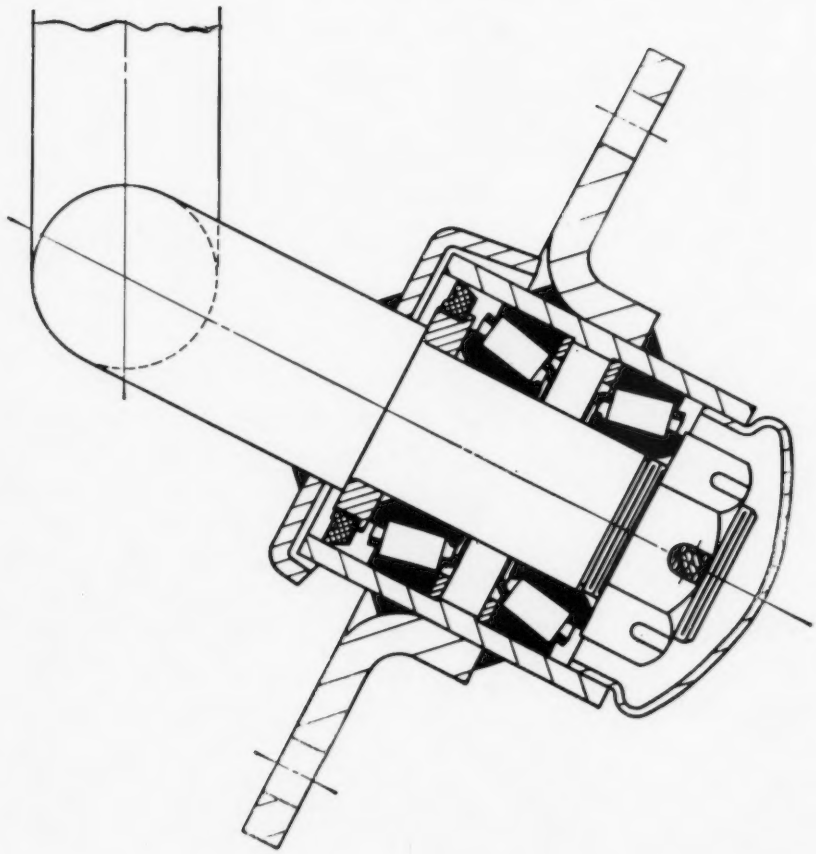

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